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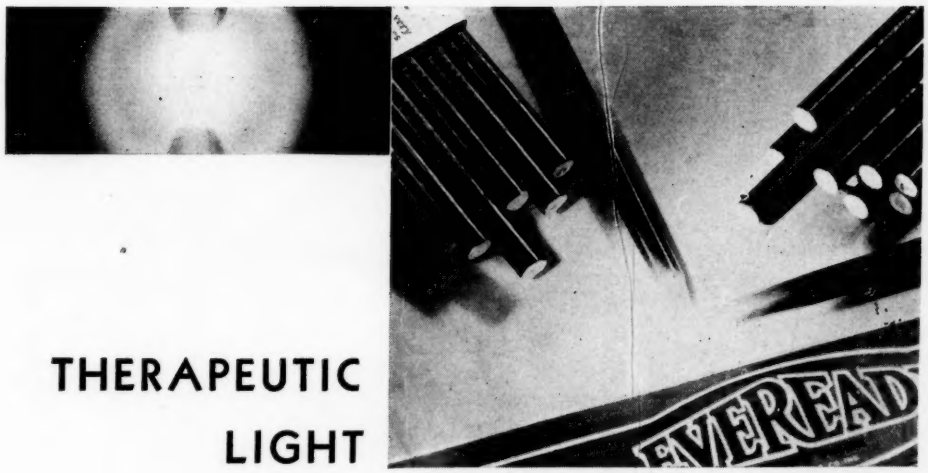

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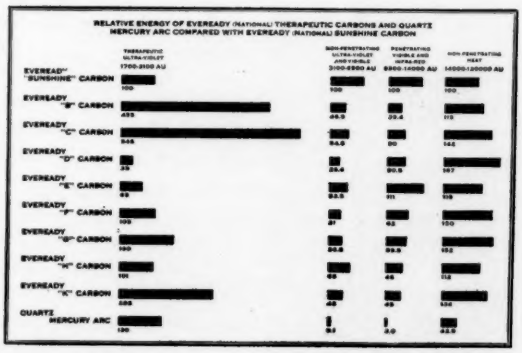
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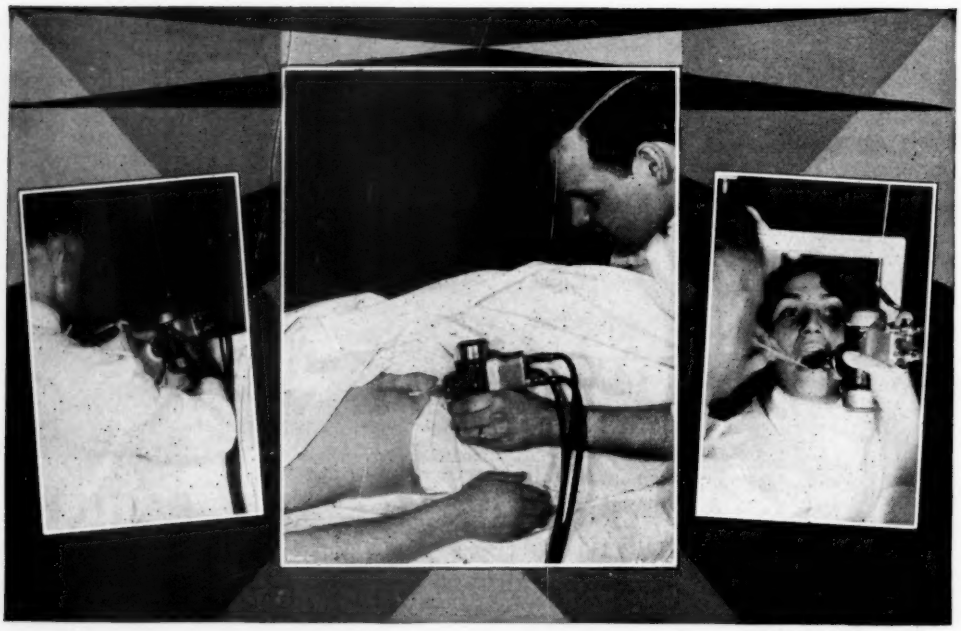

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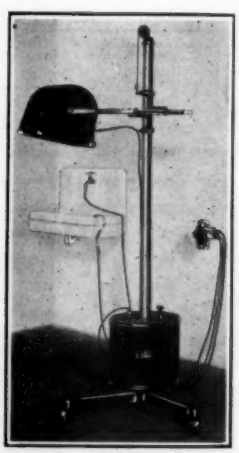

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THE EVALUATION OF PHYSICAL THERAPY IN DERMATOLOGY*

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For many years the use and application of drugs in the form of lotions and ointments was the only method available to the dermatologist, and although their limitations and disagreeable features were recognized, there was no other method of treatment available. It will, therefore, I believe, be interesting to enumerate some of the basic discoveries that lead up to the use of physical therapeutic measures in dermatology.

In 1774 Faure treated ulcers with the sun's rays and soon after other workers used lenses to focus the rays of the sun on open wounds. In 1801 Ritter, noticing that silver chloride was blackened by invisible rays situated beyond the limit of the visible violet rays, concluded that other radiant energy is present in the ether which is invisible to the eye. These radiations he termed "ultraviolet." In 1877 Downs and Blunt proved the bactericidal properties of light. In 1879 Sir Wm. Crokkes, while experimenting with a vacuum tube excited by a high tension source of electricity, discovered cathode rays. In 1889 Widmark showed that it was the ultraviolet rays in sunlight which caused erythema and pigmentation. In 1983 Finsen published his earliest experiments on the physiological action of light, and also announced the results of his treatment in tuberculosis of the skin by means of the "Finsen Light." In 1895 Wm. Conrad Roentgen discovered x-rays, and in 1898 the Curries discovered radium and other radio-active substances. In 1904 Kromayer designed the Mercury Quartz lamp, and in 1913 Ryan commenced general Carbon Arc bath treatments.

The work of these pioneers and more particularly that of Sir Cooper Hewitt, Wm. Conrad Roentgen, and the Curries, opened the way to a new era in dermatological therapeutics. The roentgen ray, as a matter of course, excited the most intense interest and, with the perfection of the Coolidge tube, the literature began to be filled with reports of the excellence of the results of roentgenotherapy in skin diseases. Of course, many accidents resulted from carelessness, from over-treatment, and imperfections in machinery. However, as time went on a rationale was determined upon and the indications for roentgenotherapy became definite. Pussey states that the changes produced by x-rays upon living tissues and upon bacteria may be summarized as follows:

(1) They cause atrophy of the appendages of the skin.
(2) They have a destructive action upon organisms in living tissue.
(3) They have a peculiar effect upon the nutrition of the living cells, producing in their less intensive action a stimulation of the metabolism of the tissues, which, when their effect is greater, go on to the point of disorganization of the cells and their destruction.

*Read at the Seventh Annual Meeting, American College of Physical Therapy, Chicago, Oct. 11, 1928.

(4) This destructive action upon living cells destroys certain diseased cells before it destroys the more resistant healthy cells of the stroma.
(5) They have an anodyne effect.

The following group of affections may, therefore be treated:

(1) Conditions where it is desired to remove hair.
(2) Where it is desired to cause atrophy, or diminution in size, or functional activity of the sebaceous glands.
(3) Where it is desirable to cause atrophy or diminution in the functional activity of the sweat glands.
(4) The stimulating effect upon metabolism of the skin.
(5) The power of causing the destruction of tissues of low resistance without the destruction of the healthy stroma, is the theoretical indication for their use in various malignant diseases.
(6) The anodyne effects come into place in the treatment of inflammatory conditions and in itching dermatoses.

Roentgenotherapy has firmly established itself as an accurate therapeutic agent, and since the adoption of an international unit of measurement of quantity and quality of rays, it has become more accurate. Where x-rays are hard to apply radium has found a definite place in in the treatment of new growths.

The so-called newer physical therapeutic measures have met with a greater amount of resistance in the attempts to show their value in dermatologic therapeutics, and a review of the literature will show opinions for and against these measures in treatment. Hartzell, in the 1917 edition of his text book of Diseases of the Skin, states that the various forms of radiant energy such as concentrated light, the x-ray, and the emanations from radium form a most useful group of remedial agents. He also states that electrolysis, high frequency current, and the ultraviolet rays also find a limited use in the treatment of diseases of the skin. Ormsby, in the 1921 edition of his "Diseases of the Skin" devotes a considerable section of his general therapeutics to radiotherapy, phototherapy, radium, and carbon dioxide snow, and comments favorably upon these methods. Pussy mentions the use of heat, the electric cautery, massage, high frequency currents, electrolysis, cataphoresis, and fulguration as measures of intense importance in dermatological therapeutics.

Up to 1920 there was not much material in the literature along the line of treatment with ultraviolet ray in skin diseases, but following this period the reports became both numerous and frequent.

1920. Miller treated a series of 100 cases of pernio with the Uviol lamp and reported better results than by any other method.

Howard Fox treated fifty cases of alopecia areata with twenty-seven cures and twelve cases of improvement. The balance had not been treated long enough to make any observations about them and Fox was convinced that this method of treating alopecia areata was more satisfactory than any he had yet tried.

1921. Bizard presented 457 cases of tuberculosis of the skin from the Hospital Saint Louis and in his analysis stated that 33-1/3% of lupus vulgaris of the face cleared up in about a year, another third in about two years, while the remainder probably would never clear.

1922. Oliver reported five cases of erythema induratum of the tuberculid group treated by the Kromayer lamp and stated that the results were uniformly good. In the same year he summarized his results with quartz lamp therapy and found the rays of great value in ulcerations, port wine type of nevus, psoriasis, chronic eczema with infiltration of the skin, and as a temporary relief in acne vulgaris.

1923. H. E. Alderson reported the use of quartz lamp therapy in psoriasis with very unfavorable results.

J. H. Sequeira reported general carbon arc light baths in the treatment of lupus vulgaris and stated that the effects observed were intense pigmentation of the whole surface, rapid healing, especially of the moist fungating lesions, increase in body weight, and increase in lymphocytes.

1924. Butler reviewed ultraviolet ray therapy and stated that, although twenty-seven years had gone by since Finsen introduced ultraviolet therapy, it was astonishing to note the varying results achieved by different observers in the application of these rays to the skin.

He reports favorable results in the tubercular affections of the skin, unfavorable in lupus erythematosis, favorable in acne vulgaris, variable in port wine mark, good in ulcers and alopecia areata.

Lane, in a marvelously interesting paper on the physiology of the skin with reference to ultraviolet ray, mentions the value of ray therapy in a number of the previously enumerated conditions and states:

"It is not a cure-all by any means, and we are undoubtedly in a period of over-enthusiasm in regard to its use, and many of the facts relative to its action and use are still a matter of conjecture. The fact remains, however, that ultraviolet light therapy has come to be a valuable method in the treatment of certain dermatologic conditions. With our increasing knowledge in regard to the action of light and the refinement of apparatus and technic, it will undoubtedly be found that certain wave lengths will have a more beneficial effect than others, or that certain of these beneficial wave lengths will have an effect on one disease and not on another. It also seems possible that an increasing use of filters will modify our technic to a certain degree."

Lumboholt treated xanthelasma palpebrarum with concentrated carbon arc light and claims good results in several treatments.

1925. W. F. Castle described a group of psoriasis cases treated by the mercury vapor lamp and stated that the majority of cases are greatly benefited by the treatment.

Ianichewski reported favorable results from the ultraviolet treatment of diffuse dessiminated scleroderma and P. Chatin reported the beneficial use of generalized ultraviolet radiation in Pyodermatitis (epidemic) in young children.

Traub used a combination of quartz lamp therapy in combination with x-ray in acne and states that the results are superior to either used alone.

H. C. Semon and M. E. Ormsby used carbon arc radiation in lupus and septic lesions with great satisfaction.

W. H. Goeckerman treated psoriasis with tar and ultraviolet radiation with good results.

W. F. Castle, in an extensive article, describes both general and local irradiation. He states that the infective groups responded well to treatment and that alopecia areata, psorasis, seborrhea, acne vulgaris, lupus, and the tuberculids, and chilblains, were all favorably influenced by radiation.

George Miller Mackee and G. C. Andrews discussed the ultraviolet ray as a prophylactic against radiodermatitis and came to the conclusion that:

(1) Actinotherapy is of some value in the treatment of chronic ulcers and telangiectasia caused by roentgen ray or radium.
(2) Vigorous actionotherapy, resulting in acute reactions, at or near the time of roentgenization, may enhance the result of the latter.
(3) Tanning of the skin by actionotherapy does not materially increase toleration for roentgen rays or radium.
(4) Preliminary generalized actionotherapy, even when continued for a long time, does not appear materially to decrease "radiosentiveness."
(5) It is possible to administer several or many times the standard erythema dose of roentgen rays to a normal human skin without effecting more than a mild visible reaction. Ignorance of this fact may account for the erroneous assumption that actinotherapy is a prophylactic against roentgen ray and radium injuries.
(6) The authors believe that the ultraviolet ray, regardless of how employed, is of no practical value as a prophylactic against acute or chronic radiodermatitis.

(7) They also believe that a combination of the ultraviolet ray and the roentgen ray is more likely to be followed by sequelae such as telangiectasia than the application of the roentgen ray alone.

1926. C. G. Lane stated that the effects of the ultraviolet light on the various characteristics of the roentgen telangiectasia and ulcerations to be as follows:

(1) The telangiectases are well obliterated near the periphery and in the smaller areas. The larger vessels are not affected, and it is not advisable to increase the time or pressure enough to try to obliterate these.
(2) The atrophy remains the same, but there is definite improvement in the texture of the skin.
(3) The pigmented areas remain unaffected.
(4) The scarring from tuberculous processes is also unaffected.

Certain precautions are to be registered:

(1) Superficial ulceration, perhaps through low grade infection, can be produced by overdosage. The ulcerations heal slowly and leave a suspicion of malignant change.
(2) Treatment on too many areas, or areas too near together, are inadvisable at one time.
(3) Cleaning the skin with alcohol or ether will increase the amount of reaction.
(4) Itching may be increased, especially in cold weather, and one must guard against the trauma from scratching and the possible infection of these excoriations.
(5) It is well to avoid areas of dense scarring and pigmentation because of the possibility of causing necrosis in the former, and of stirring up melanotic changes in the latter.

Joseph Becker commented upon the unfavorable reports of quartz light treatment in erysipelas and believed that it was due to ineffective dosage. He claims good results with his method.

Eschiveiler found that local and general treatment with the carbon arc was of benefit in various forms of lupus.

1927. J. B. Ellison used the air cooled quartz-mercury vapor arc in the treatment of impetigo and found excellent results, with the shortening of the time of disability.

P. S. Meyer gives an excellent and comprehensive summary of this subject. In discussing the uses of Wood's light he mentions that Keller has by this means demonstrated pityriasis versicolor on the scalp. Bommer, Margerot and Deveze found that tricophytosis gave a greenish fluorescence, and pityriasis versicolor dark yellow to orange, and much more intense than in pityriasis rosea and seborrheic eczema. A Kromayer lamp fitted with Wood's glass and used as a hand lamp is recommended as a most convenient apparatus. Erythrasma fluoresced a pronounced orange color. Psoriasis was silver, and seborrheic eczema, orange.

He discusses the therapeutic uses of light, and finds that successes have been claimed by general irradiation in dermatitis herpetiformis and in pemphigus vulgaris. Sooy and Moise have treated ten cases of idiopathic purpora hemorrhagica with light baths, with very good results. They base their treatment on the experimental discovery that in rats a considerable increase in blood platelets was found after ultraviolet ray treatment. Meyer describes how in some cases of hypersensitiveness to external irritants, known and unknown, a general desensitization can be effected by a course of increasing exposures to ultraviolet rays. This was successful in one case of prurigo estivalis which was treated during the winter.

S. E. Dore did not feel quite so enthusiastic about the results of actiontherapy. He doubted that many extensive cases of lupus were cured by unaided light treatment. He stated that with surgical measures and such applications as acid nitrate of mercury, and pyrogallic acid he had been able to accomplish in a short time, although with more pain and scarring, what it would take months of light treatment to achieve. He also thinks that the cases of alopecia areata which have been reported as cured might possibly have gotten well spontaneously, and that the action of the light is nothing more or less than an irritating one, which might as readily be pro-

duced by the ordinary irritants. In acne, he stated that the improvement was due to the exfoliation of the skin and that impetigo and staphlococcic infection may be treated by ordinary antiseptic applications.

No doubt some of Dore's contentions are true, yet as Wise says, that although a patch of lupus might be destroyed in a variety of ways ranging from the application of an acid or an ointment to the scalpel of a surgeon, the dermatologist is fortunate in having at his disposal several modes of attack in many different lesions of the skin and mucosa, which enables him to make a judicious choice of treatment in a given lesion. In making this choice he takes into consideration a number of elements such as safety, time, pain, complications, rapidity of cure, proneness to recurrence, and cosmetic results. I think that these factors should enter into consideration when choosing any type of therapeutic agent and that the dermatologist who has at his finger ends and in his office equipment a larger variety of therapeutic agents does the best work.

The Direct Current

The direct current has been commented upon by W. G. Turrell, who comments on the fallacy of would-be ionic medication and states that the results obtained are not specific drug reactions, but are due to the electrolytic action of the galvanic current, and that they are similar whether expensive drugs, or common salts are used for the solution.

G. T. Pack, E. P. Underhill, J. Epstein, and I. N. Kugelmas, Amer. J.M.Sc., 167:625, May, 1924, studied the so-called electrolytic absorption of drugs and agreed with the work of Turrell and Clark that ionic medication might be indicated in local conditions and while deep ionic medication is impossible, beneficial results do accrue from the ionizing effect of the current alone, and that the beneficial results are obtained by the drastic tissue changes which are produced.

Diathermy.

Bathhurst described surgical diathermy and recommended it as superior to other methods for removing abnormalities from the skin. He stated that its superiority lay in:

(1) The rapidity with which the treatment could be carried out.
(2) The absence of inflammatory reaction.
(3) The accuracy and limitation which could be secured to definite areas.
(4) The accuracy with which depth can be gauged and regulated.
(5) The minimum amount of scarring produced.
(6) The relative painlessness of the treatment.

G. F. Pfahler recommended dessication very highly in the treatment of keratoses and malignant degeneration following radiodermatitis, stating that this method of treatment gave better results than any other.

G. C. Andrews commented upon the accuracy of control which made it extremely valuable in the treatment of small lesions in which cosmetic results were important.

Wise and Eller commented favorably on the use of endothermy, particularly if it was used as an adjuvant to other modes of treatment, and stated that the cosmetic results following dessication compared favorably with those obtained by roentgen rays and radium, the scar often being softer and smoother, and the skin approximating the appearance of normal skin. They also stated that dessication produced little degenerative change and a minimum of disintegrated tissue with a limited formation of fibrous tissue, producing a satisfactory scar.

J. Hunter reported a case of a woman who was severely affected with furunculosis. He treated this condition by diathermy with favorable results and no recurrence of the lesions.

H. Bordier treated a case of roentgen ray ulceration by diathermy with complete healing in four months. An interesting report on the treatment of the thymus in several cases of psoriasis was given by R. V. Lesczynski. He stated that the time required for the cure of psoriasis was from five to twelve weeks. The permanency of this was not gone into.

SUMMARY

1. The various physical therapeutic measures, x-ray, radium, ultraviolet ray, diathermy,

particularly surgical diathermy, are discussed and the most important literature presented.

2. The value and importance of roentgen and radium therapy is presented.

3. The literature on the newer physical therapeutic measures-ultraviolet radiation, the direct current, and surgical diathermy, is presented.

4. The growing importance of these measures is shown.

5. The value of ultraviolet ray for pernio, alopecia areata, tuberculosis of the skin, ulcerations, portwine marks, psoriasis, chronic eczema, acne, and scleroderma, are shown.

6. The growing importance of endothermy as a definite procedure in dermatology, in new growths, facial blemishes, and conditions where cosmetic results are important, is demonstrated.

7. The unimportance of the direct current in dermatology is discussed.

CONCLUSIONS

What are we to gather from this review? We can only gather that those who use physical therapy in dermatology must be divided into groups:

1. Those who exaggerate its value and use it as a cure-all to the exclusion of all other methods.

2. Those who condemn it out of hand because of lack of experience, improper use, and disappointment in that it has not proven a universal panacea.

3. Those who use it properly in selected cases and as a valuable aid—quite as valuable as salicylic acid, sulphur, or resorcin.

4. There is another group who use physical therapy and find it to be of real aid in their therapeusis, but who fear to express themselves, because they might be liable to be accused of enthusiasm for measures that have not become hoary with age.

How, then, are we to evaluate physical therapy in dermatology? Shall it be that of a mysterious agent having unknown and mysterious qualities, productive of miraculous cures, or shall it be that of a known physiologic medicant, administered in doses of known quantities as one of a number of therapeutic agents, and producing a definite physiologic effect? The latter seems the more logical approach. Not too much! Not too little! But let us at least keep our feet in the broad highway, and our hands on the latest developments, so that we may at all times use those measures which seem to us the best.

PRESCRIBING ULTRAVIOLET*

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Several of the physical agencies used for therapeutic purposes have now reached the quantitative stage in the study of their effects and uses, and of these, ultraviolet rays are probably most thoroughly understood and accurately used, at the present time.

With our present understanding of the powers and properties of radiant energy, we can begin to apply it with a certainty and directness approximating that with which the intelligent physician now uses drugs. We can apply whole sunlight, which contains all or most of the types of energy now in use, and which corresponds to a fluid extract or tincture; or we can select certain special parts of the energy spectrum, corresponding to the active principles of drugs, in order to accomplish certain definite and specific results.

Before prescribing any medicines, the conscientious physician makes a careful and detailed examination of his patient, sufficiently complete to enable him to arrive at a sound diagnosis. This includes an accurate history, a full record of the subjective symptoms and a thorough study of all the objective signs of disease, including those elicited by all laboratory tests which are considered essential to an understanding of the morbid processes present. The sincere physical therapist should certainly do no less than this. Since ultraviolet rays are a medicine, which we now recognize as having large powers for harm, as well as for benefit, this remedy must be studied as carefully and in as full detail as one would study a drug obtained from the vegetable or mineral kingdom. We must have a full knowledge of its pharmacology, toxicology and therapeutics.

Pharmacologic studies of this agency have been proceeding for a number of years. The early experiments of Bovie, with his various broods of chickens, which demonstrated the tonic and antirachitic properties of these rays, and those of Swingle and Rhingold, which showed that they were able to relieve tetany in parathyroidectomized dogs, as well as the reports of many other workers along similar and diverse lines, are now among the classics of medicine and need not be recapitulated here, as the outcome of this work is now well coordinated and generally understood and accepted.

This discussion will be confined to the ultraviolet rays used for general therapeutic purposes, the so-called *vital rays*—those between 2900 and 3200 Angstrom units—as applied by means of carbon arc and flame lamps and the air-cooled, quartz mercury apparatus. The shorter, germicidal rays, generated in the water-cooled burners, may be considered as *surgical ultraviolet* and make a fascinating story in themselves.

The *physiologic effects* of ultraviolet rays are *direct* and *indirect*. Directly they act as a *counterirritant*, producing the typical erythema seen in sunburn. This effect is more pronounced when a new quartz-mercury generator is used than when the carbon arc lamps are employed, and is *progressive*, continuing to develop, in some cases, for 24, 48 or even 72 hours after the treatment is given.

The indirect effects, which are far more important, are *chemical* in their nature and appear to take place chiefly in the sterols present in the skin, particularly *ergosterol*. These rays undoubtedly act in other ways, which are not yet fully understood.

The vital ultraviolet rays, in therapeutic doses: (1) Fix calcium, phosphorus, iron and iodine in the body; (2) break down bacterial toxins; (3) increase the hemoglobin and the cellular elements in the blood; (4) normalize metabolism and glandular activity; (5) accelerate the blood and lymph flow and increase

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elimination; (6) sedate the central and stimulate the sympathetic nervous system; (7) ease certain types of pain; and (8) increase resistance to infection, by virtue of some of the other effects mentioned. The shorter rays, when applied through a quartz applicator, with pressure, are strongly germicidal.

Toxic effects are by no means unknown or negligible. Over-doses of ultraviolet rays cause a severe *erythema,* even to the extent of blistering the exposed areas, with the constitutional symptoms which would accompany such a condition produced by direct sunshine or any other cause, such as lassitude, vertigo or even vomiting. They also *reduce* the cellular elements in the blood and the resistance to disease and probably cause chemical changes deleterious to the organism. For this reason, the use of this agency should be strictly confined to trained physicians or to persons working under their direct uspervision or under prescribed and controlled conditions.

The *antidote* to overdoses of ultraviolet rays is the application of radiant heat-light, generated by a 1,000 to 2,000-watt tungsten bulb, in a proper apparatus. In the absence of this agency, alkalis, such as a solution of sodium bicarbonate, or antiseptic-analgesic ointments, such as that of Butesin Picrate, may be applied to the affected parts.

When an overdose has been given, no further irradiations should be applied until all unpleasant effects have disappeared; and then the dose should be small and should be increased with great caution.

The best-defined *therapeutic indication* for ultraviolet rays is for the prevention and cure of *rickets* and *tetany* and in the minor degrees of *calcium and phosphorus deficiency.* They compensate, to a considerable extent, for the loss or inefficiency of the parathyroid glands, for a diet deficient in *vitamines* and for insufficient exposure to sunlight.

Pregnant and lactating women should be regularly treated with ultraviolet rays (at the same time giving them *calcium lactate,* preferably combined with lactose and administered when the stomach is empty), in order to compensate for the loss of calcium which takes place at these periods. Infants should also receive regular courses of ultraviolet irradiations for a month or six weeks, at least, during the winter, for the first two or three years.

These rays are also of distinct value in cases of *"neurasthenia"* having no discoverable organic basis; in general malnutrition, *lack of vitality* and mild, unexplained *anemia;* in *acidosis* with calcium deficiency; in *asthma* and *hyperesthetic rhinitis* (applied locally, with a quartz applicator, and generally, with a quartz-mercury or open arc lamp); in *chronic bronchitis* and sensitiveness to acute respiratory disorders; in the treatment and prevention of *x-ray burns* and the treatment of burns from other causes; in certain types of *obesity;* in *carefully selected* cases of *tuberculosis,* particularly when it involves the bones, glands or peritoneum; in a considerable variety of *skin diseases;* and probably in a number of other conditions, especially those dependent upon *lowered systemic resistance,* which have not yet been fully worked out.

Administration and Dosage.—The physician should consider the various types of apparatus for producing ultraviolet rays and select the one best suited to his needs and facilities; after which he should study his apparatus thoroughly, from the mechanical and therapeutic standpoints, so as to be able to develop its possibilities to the greatest extent.

Since much of the effect is produced upon the blood, it is well to increase the amount of that fluid in the skin by the antecedent or simultaneous application of radiant heat-light or infra-red rays. For this reason, the open carbon arc lamps have certain advantages, as they combine the various types of rays. When a germicidal effect is desired, the blood should be squeezed out of the part by pressure with the applicator.

Dosage depends upon five main factors:

1. The individual sensitiveness of the patient.

2. The intensity and composition of the radiation.

3. The distance between the skin and the arc.
4. The duration of the exposure.
5. The temperature.

Patients vary greatly in their susceptibility to the action of ultraviolet rays, and this must be determined by accurate tests on small, localized areas of the skin before prescribing treatments. An elaborate apparatus for making these tests have been devised b yone of the manufacturers, but can be satisfactorily replaced by a piece of cardboard in which six or eight apertures, about 1 cm. in diameter, have been cut, at intervals of about 2 cm.

In use, such an apparatus is placed over the flexor surface of the forearm or at one side of the dorsal spine, the rest of the body and all but the lowest of the apertures being covered. The lamp should be operated under standard conditions and at a standard distance—say 30 inches (75 cm.). After an exposure of 1 to 5 minutes (depending upon the general rules of sensitiveness and the type of apparatus used, as will be explained presently), the second aperture is uncovered, and so on with five to eight of the apertures, at intervals of 1 to 5 minutes, a careful record being made of these exposures. The forearm or back of the patient should be examined after 12, 24 and 48 hours and a decision as to the time of the initial treatment and the rate of increase desirable should be arrived at from a study of the areas exposed during the test.

As a rule, an initial treatment of 1 to 3 minutes, at a distance of 30 inches (75 cm.), should be used as a standard. The dose may be increased by increasing the time or decreasing the distance, or both. In children, it is better to increase the time, keeping the distance constant.

As a general rule, larger doses will be required by those who have dark complexions or tan easily, and where congested skin areas are being treated. When pigmentation or tanning results from the treatments, the doses must be increased.

Smaller doses will be required by fair people and those with blonde or reddish hair, by those who blister easily, and where normal skin is being treated.

Exposed parts of the body will tolerate larger doses than will those which are habitually covered; women generally require 25 percent smaller doses than do men; children, 1/2 the adult male dose; and infants, 1/2 the dose for a child; mucous membranes require more than the skin dose.

It should be borne in mind that patients who have recently been taking *quinine* are much more sensitive to these rays.

If a quartz-mercury lamp is employed, allowance must be made for the number of hours it has been operated, as the intensity of its radiations diminishes progressively with use. A standard time must also be allowed for the "building up" of the power of the inclosed arc.

The open arc lamps are of the crater and flame types, the latter often using carbons impregnated or cored with various metals or their salts, so as to produce especially powerful emission in certain parts of the spectrum. These facts should be carefully studied in all their details before use is made of the rays emitted from such sources.

In writing a prescription for ultraviolet treatments, the type of apparatus (in the case of quartz-mercury lamps, the *exact instrument*) to be used, the kind of carbons (if an open, flame lamp), the distance from the skin, the length of exposure, the part of the body to be exposed, the amount of increase at successive sittings and the frequency of treatment must be accurately stated.

The frequency of treatment depends upon the degree and duration of the resulting erythema, which can be determined only by careful experiment and observation. In general, the rule is that no part should be reirradiated until all acute effects of the previous treatment have subsided. In patients who show a persistant or developing erythema, *fractional exposures* of first one part of the body and then another may be employed.

In a brief discussion such as this, only general principles can be suggested. These are, however, far more important than details, because the intelligent man who knows the principles can work out the details to suit each individual case.

If physicians will understand that ultraviolet rays are a remedy potent for good or harm; will study their characteristics, indications, limitations and dangers; and then will apply or prescribe them, with the same attention to details of individual susceptibility, physiologic action, dosage and frequency of application, and with the same meticulous judgment which they employ in the use of drugs, the results obtained will be equally predicable and satisfactory.

THE EFFECT OF ULTRAVIOLET LIGHT ON THE BLOOD—A PRELIMINARY REPORT*

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The purpose of this study was to determine the effect of ultraviolet light on the red blood cells, the white blood cells, hemoglobin, coagulation time and blood platelets. It was prompted essentially because of the non-uniform results obtained by the numerous investigations.

Many studies have been made on the effect of irradiation on the formed elements of the blood. It is generally known that the number of red blood corpuscles are increased after exposure to the ultraviolet rays. Furthermore, it is uniformly agreed that the blood picture, especially the red blood cells and hemoglobin are increased in high altitudes.

In this paper, a preliminary report, I shall attempt to review the results of my study of about 40 cases picked at random from our outpatient department at Northwestern University which were exposed to ultraviolet rays. In this work no blood dyscrasias were included. Controls of 15 apparently normal individuals were used to prevent error or false conclusions.

Energy Sources:

The burner used was a new uviarc burner which operated at 70 volts and on an average of 3.6 amperes. The spectrum emitted was between 8,000 and 2,200 Angstrom units, the latter figure representing a very low intensity. Within this range there were several bands of varying intensities. The energy distribution-curve was the same as that from any standard uviarc burner.

Technic.

The distance utilized was a 40 inch tube-skin distance. Initial exposures varied from 2 to 3½ minutes, depending upon individual skin sensitivity, with a regular increment of time according to sensitivity of patient. No irradiation exceeding fifteen minutes.

Effect on the Red Blood Cells and Hemoglobin:

Many investigators have agreed that there is a definite increase in the red blood cells and hemoglobin. The opinion of the majority is that altitude alone will induce an increase in the red blood cells and hemoglobin, and that the absence of light will have little permanent effect upon them; its effect, if any, is fleeting.

Janet Clark (1) (in 1922) reviewing the literature with reference in regard to the physiological action of light, states that the effect of sunlight on the erythrocyte count is not very marked. Hyde (2), in the lowlands, found a very definite increase in the number of red blood cells and hemoglobin, and Lenkei (3) reported an 8% increase in erythrocytes.

Reidel (4) in 1921 found an increase in hemoglobin following long solar irradiation, but

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only slight changes with the quartz mercury lamp.

Berner (5) and Lowenhardt (6) in their investigations found no increase in red blood cells and hemoglobin; Aschenheim (7), Gelera (8) and Barenberg (9) found no increase in red blood cells and hemoglobin.

Sanford (10) in his series of irradiations on infants found:—

1. A large number of infants did not show any changes and a considerable number showed a definite decrease in the number of red blood cells and hemoglobin content and summarized his findings as follows:

'a) "The percentage of hemoglobin in the blood of new born infants is not so high as is usually quoted.

(b) Short exposures to ultraviolet light increases the hemoglobin content and number of red cells to a slight extent in an average number of cases. There is a rapid return to normal.

(c) Short exposures to ultraviolet light increases the hemoglobin content and number of red blood cells to a greater extent in cases in which the hemoglobin content and number of red blood cells are lower than normal. They tend to remain nearly normal."

Our series of cases picked at random in our outpatient clinic consisted of:

Arthritis	17	cases
Postoperative Nephectomy	1	"
Thyroid	2	"
Furunculosis	1	"
Alopecia Areata	1	"
Asthma	2	"
Focal Infection	1	"
Tuberculosis (?)	1	"
Tuberculosis Adenitis	1	"
Tuberculosis Abscess of Cheek	1	"
Pyelitis	1	"
No Definite Diagnosis	2	"

1. *On Fractional Method*:

Ultraviolet ray given twice an thrice weekly:

(a) 13 cases irradiated.

(1) 7 cases showed a slight decrease in red blood cells.

(2) 6 cases showed a slight increase in red blood cells.

2. *Full ultraviolet or general exposure.*

(a) 18 cases irradiated.

(1) 12 cases showed a definite decrease in red blood cells.

(2) 6 cases showed a slight increase in red blood cells.

In the general ultraviolet ray irradiations there seems to be a more definite decrease in the red blood cells than that given by the fractional method.

Effect on the white blood cells.

Katherine Spence (11) found a definite increase in the total number of white cells, affecting both the polymorphs and the lymphocytes, but occasionally the reverse was found. Blood examinations made at intermediate states showed that the changes were gradual and even throughout the course of treatment.

Rollier (12) found an increase in the number of leukcocytes 10000 to 13000 with an increased percentage of polymorphonuclear cells in early exposure to sunlight and later in cases with good prognosis an increased percentage of lymphocytes.

Janet Clark (1) in her review of the literature stated that effect of sunlight on the erythrocyte count is not very marked whereas the white blood cells, especially the lymphocytes respond to short exposures of any radiation (sunlight, ultraviolet, x-ray, heat).

All published reports agree that ultraviolet rays stimulate a lymphocytosis in men and animals.

She has further found that ultraviolet rays shorter than 300$\mu\mu$ can stimulate a lymphocytosis (of about 3 weeks duration) in contrast to the longer ultraviolets which show a marked depressing effect on the lymphocytes and to a less degree on the polymorphonuclear leukocytes.

J. Bell Ferguson (13) has found an increase in the leukocytes after even one dose, about 2000 to 4000, which reached its height in about 4 or 5 hours after exposure.

Colebrook, Eidenow and Hill (14) showed that when the skin was mildly irritated with ultraviolet radiation, radiant heat or mustard baths, there was a definite increase in the bactericidal power of the blood.

Eidenow (15), in a series of 150 cases, concluded that the heightened bactericidal potency is associated with erythema, thereby showing that it is the effect principally of the ultraviolet rays.

NORMAL BLOOD COUNTS—BEFORE AND AFTER IRRADIATION

R.B.C	W.B.C.	PL	SL	LL	Hb.	Coag.		Platelets
Mrs. M. R.								
5500000	6400	62	27	11	90	2¼	min.	550000
3840000	7500	62	22	16	80	2¾	min.	250000
Mrs. O.								
4320000	6600				80	3	min.	
Mr. A. O.								
4640000	10000	70	14	8	85	6¼	min.	360000
4800000	9000	72	12	10	90	3½	min.	480000
Mr. W. D.								
4720000	8200	68	16	8	85	5½	min.	225000
3850000	7200	66	21	10	75	3½	min.	400000
Mr. C. S.								
4000000	5200	60	19	18	80	4¾	min.	260000
4280000	8800	69	20	9	85	4	min.	325000
Mr. J.								
4620000	7000				90	4½	min.	
Mr. B. D.								
3870000	4800	63	25	12	75	5¼	min.	290000
3750000	7600	67	22	11	75	3	min.	350000
Mr. R. S.								
4250000	4800	62	27	11	85	5½	min.	300000
4750000	8400	65	25	10	95	1½	min.	555000
Mr. J. F.								
3520000	4800	66	20	12	75	3	min.	250000
3850000	7200	70	19	8	80	4	min.	425000
Mr. J. W.								
4280000	4800	62	27	11	80	55/6	min.	250000
4280000	7400	69	16	11	85	2¾	min.	480000
Mr. M. B.								
3650000	8200				90	3¼	min.	
Mr. M. P.								
4000000	5600	63	26	10	75	41/6	min.	300000
4500000	7000	67	18	10	80	5	min.	300000
Mr. S.								
4800000	8200	69	20	9	90	3½	min.	360000
4350000	8000	65	23	10	85	3	min.	450000
Mr. B.								
4800000	6000				90	5	min.	
Mr. G. O.								
4500000	5000	64	18	18	90	3¾	min.	300000
4250000	6600	68	20	10	85	2¾	min.	450000
Mr. H. M.								
4260000	5400	62	20	18	85	41/3	min.	280000
5250000	9400	60	27	13	90	2¾	min.	525000

Hemoglobin—Talquist.
Coagulation—Capillary Pippette.

In our study the following was found:

Normal cases irradiated:

Leukocytes:—

8 cases showed a definite increase.
4 cases showed a slight decrease.

Lymphocytes:—

6 cases increased.
6 cases decreased.

ABNORMAL BLOOD COUNTS—BEFORE AND AFTER IRRADIATION

GENERAL

R.B.C.	W.B.C.	PL	LL	Hb.	Coag.		Platelets
Mr. K. M. (Alopecia)							
6040000	7950	63	35	95	2	min.	292336
5520000	6800	70	26	80	3½	min.	272136
Mrs. M. M. (Arthritis)							
4870000	8300	68	31	75	2	min.	329186
4780000	8950	78	20	75	3	min.	194414
Mrs. Z. O. (Arthritis)							
5720000	5850	59	38	85		min.	
4410000	5660	58	40	80	2½	min.	
Mrs. J. C. (Arthritis)							
4220000	5050	71	29	95	3½	min.	237164
3240000	5250	49	50		2½	min.	130896
Mrs. E. L. (Arthritis)							
5150000	8600	64	36	85	2	min.	309030
4820000	8900	61	36		1½	min.	318120
Mr. H. G. (Asthma)							
5300000	7200	60	29			min.	
4090000	5000	43	53			min.	
M. L. R. (Tb. abscess of cheek)							
4360000	9800	50	50	75	4½	min.	292556
4090000	10800	46	54	80	2	min.	326420
Mr. R. M. W. (Tb.?)							
5680000	7500	39	58			min.	
4300000	6050	37	62			min.	
D. K. (Asthma)							
5110000	9650	40	56	80		min.	
3740000	11200	65	34	80		min.	
Mrs. M. W. (Arthritis)							
5770000	6275		45	85	3½	min.	308118
4430000	11150	70	30	90	4	min.	
Mr. J. L. (Arthritis)							
4820000	8550	64		90	3½	min.	300286
4380000	8500	68	31	85	1½	min.	236520
W. B. (Pyelitis)							
4120000	5950	35	65	80	4	min.	226480
3830000	5950	32	68	65	2½	min.	290640
Mrs. M. R. (Arthritis)							
4450000	6050	69	30	75	3	min.	226950
4610000	7150	72	27	80	2½	min.	272244
Mrs. B. N. (Arthritis)							
3560000	4900	55	45	75	5	min.	196740
4310000	5250	42	51	80	3½	min.	234190
Mrs. M. S. (P. O. Thyroid)							
3550000	7050	60	36	80		min.	
3860000	5350	53	47	75		min.	
M. N. (Arthritis Deformans)							
3880000	7550	72	26	75	2½	min.	204476
4630000	12550	74	26	80	¾	min.	190293
D. C. (Tb. Adenitis)							
5300000	10600					min.	
5640000	9950	63	30			min.	
F. R. (Arthritis)							
4000000	6300	64	35	80	2½	min.	180000
4810000	5500	60	37		1½	min.	243867

Abnormal cases:

13 cases (Fractional)

Leukocytes:—

8 cases showed a definite increase.

5 cases showed a definite decrease.

Lymphocytes:—

8 cases showed a definite increase.

3 cases showed a definite decrease.

2 cases showed no change.

18 cases (General)

Leukocytes:—

9 cases showed a decrease.

7 cases showed an increase.

2 cases showed no change.

Lymphocytes:—

8 cases showed an increase.

5 cases showed a decrease.

2 cases showed no change.

Coagulation Time.

In surveying the literature in regard to the effect of ultraviolet light on coagulation time, I was surprised to note very few specific reports. In 1924, Paginez, Ravina and Solomon (16) found that irradiation of almost any part of the body caused a decrease in coagulation time. In my experimental work I found in a group of 23 patients the following:—

Coagulation time decreased in 13.

Coagulation time increased in 5.

Coagulation time showed no change in 5.

Blood Platelets.

The effect of ultraviolet light on blood platelets has been observed by various investigators. It is not definitely known at the present time what the origin of blood platelets is. Many theories of their formation have been described.

Cramer and Drew (17) are inclined to the view that blood platelets are formed by the endothelial cells of the blood vessels and lymphatics. Any stimulating substance affecting the endothelial cells may result in an increase in the formation of these platelets.

Bannerman (18) has found that a hot sun bath is followed by an increase in the number of blood platelets. He also found that in infections, like ordinary cold, influenza and measles, the blood platelets were reduced, and in chronic pulmonary tuberculosis the blood platelets were increased. A reasonable explanation of the above phenomena has not been satisfactorily advanced.

My results show that out of 12 patients of the normal group irradiated, there was an increase of almost 100% of blood platelets in each case, while in the abnormal group consisting of 23 patients, 14 showed definite increase in blood platelets and 9 showed decrease.

Conclusions:

1. Of the 31 abnormal cases studied, there was a definite decrease shown in the red blood cells in those cases receiving a general exposure.

ABNORMAL BLOOD COUNTS—BEFORE AND AFTER IRRADIATION

FRACTIONAL

R.B.C.	W.B.C.	PL	LL	Hb.	Coag.		Platelets
Mr. E. F. (Arthritis)							
5950000	6500	61	37	80	3½	min.	250000
4300000	5850	60	40	80	3	min.	300000
Mr. R. D. (Nephrectomy)							
4450000	10500	81	15	80		min.	
3230000	12400	71	27	60		min.	
Mrs. G. A. (Focal Inf.)							
4240000	7900	54	44	75	3½	min.	260000
4050000	9800	46	54	85	3½	min.	280000
Mrs. D. M. (Arthritis)							
5440000	7050	64	32	90	2¾	min.	
4700000	5800	61	39	85	3	min.	190000
Mr. J. K. (Arthritis)							
5030000	6300	63	29	90	3½	min.	200000
4050000	6850	62	36	85	3½	min.	250000
Mrs. E. T. (Thyroid)							
5700000	6100	70	30	75	3½	min.	290250
5640000	7050	65	36	85	3½	min.	325992
Mr. V. K. (Furunculosis)							
5010000	10850	75	23	80	3	min.	200000
4490000	6800	63	32	80	2½	min.	198458
Mr. P. S.							
3560000	7500	70	30	80	3½	min.	200000
4055000	6400	71	29	75	3½	min.	200317
Mr. A. H. (Arthritis)							
4520000	11000	60	39	85	3½	min.	228000
4910000	8800	59	39	80	3½	min.	314240
Mr. G. S. (Arthritis)							
4560000	8400	48	42	90	3	min.	261744
4770000	8550	53	37	90	3	min.	231345
Mr. E. R. P. (Arthritis)							
5100000	7220	64	25	75	3½	min.	290000
5440000	7300	60	35	75	2½	min.	350000
Mr. G. R.							
4600000	4350	61	30	90		min.	
4630000	3250	49	44	85		min.	
Miss J. S. (Arthritis)							
3850000	7200	73	27	80	3	min.	336875
4800000	8900	67	32	85	2¼	min.	298604

R.B.C.	W.B.C.	PL	LL	Hb.	Coag.	Platelets
R.B.C.	W.B.C.	PL	LL	Hb.	Coag.	Platelets
R.B.C.	W.B.C.	PL	LL	Hb.	Coag.	Platelets
R.B.C.	W.B.C.	PL	LL	Hb.	Coag.	Platelets

R.B.C.	W.B.C.	PL	SL	LL	Hb.	Coag.	Platelets

2. The changes in the white blood cells and lymphocytes showed a definite increase in those cases irradiated with the fractional method, and in the general irradiation there seems to be no appreciable difference.

3. The hemoglobin showed a slight increase with both methods.

4. Coagulation time was definitely decreased in 60% of the cases.

5. Blood platelets showed an increase of 100% in every case studied.

6. The above results although of a definite figure, will need further observation and study. A continued report will be published at some further date.

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DISCUSSION

DR. KIME: Were all those blood counts made by the same technologist on the same basis

CHAIRMAN DORNE: Those of the abnormal cases were made by the same man at the school. The normal cases were taken at some other p.ace. The same man took the plates as before with the same methods used.

Discussion on papers of Dr. Lake, "Prescribing Ultraviolet;" Dr. Dorne, "The Effects of Ultraviolet Radiation on the Blood;" Dr. Senne, "The Effect of the Ultraviolet Rays in Experimental Rickets; with Studies on the Lime Depositing Capacity of the Light."

DR. VICTOR E. LEVINE (Omaha): The question of ultraviolet light and dosage is an important one and must be considered from several angles. In the first place I wish to mention the fact that we may employ other means than those of purely physical nature to attain the proper dosage. In this connection it is interesting to note how Maughan and Smiley arrived at the dosage used in their experiments proving that ultraviolet light cuts down the incidence of the common cold about 40 per cent.

Maughan and Smiley figured that a man of sedentary habits would spend in a week not over one-half per day out in the sunshine with head, neck, ears and forearms exposed. According to Sappy the surface of the body of a man of average size equals about 15,000 sq. cm. distributed as follows:

Head	1,323
Neck	340
Trunk	4,346
Legs	5,516
Arms	3,558
Ears	62
Other Surfaces	214
Total	15,359

Assuming that the direct sunlight strikes only half the surface of the body at a time, there would be with head, neck and arms exposed, approximately 367,920 sq. cm. minutes of exposure per week—1752 x 30 = 367,920 cm. minutes.

Ultraviolet intensity is, according to Pacini, four times greater in the mercury vapor lamp than in sunlight. The man who takes ten minutes irradiation from the usual mercury vapor lamp at a distance of 30 inches per week is exposed approximately to as much ultraviolet light as the ordinary city dweller in the summer. This amount of irradiation Maughan and Smiley gave to their experimental human subjects during the winter and protected a good many against the common cold.

The erythema dose has not always proven a useful index. As Dr. Lake has stated erythema may increase in intensity forty-eight and even seventy-two hours after exposure. It may be difficult to determine the degree of erythema developed. Furthermore Mayer has observed that browning of the skin was not necessary in the cure of rickets and that in extrapulmonary tuberculosis favorable results have been obtained where no pigmentation of the skin developed. Individual sensitivity to ultraviolet may markedly effect the onset and intensity of the skin reaction. Metabolic disturbances are other factors that influence the reactivity of the skin. Alterations in the acid-base equilibrium in the blood will cause a variation in the reaction of the skin to the ultraviolet rays.

In connection with purely physical means of measuring ultraviolet we may also adopt biological methods. Dr. Sonne and Dr. Dorne have spoken of the effect of ultraviolet on the blood. The chemical effects, alterations in serum-calcium, and morphological effects, alterations in erythrocytes and leukocytes, may yet prove a valuable indication in the dosage of ultraviolet rays.

It is a well known fact that when we overdose with ultraviolet the red cells and the hemoglobin and the blood platelets may be reduced to a subnormal level. By means of proper dosage we may arrive at the dividing line between the normal and subnormal. We may strike a happy medium whereby we can regulate the amount of radiation necessary to bring about maximum biolcgical effect in the particular patient under our treatment.

We are also likely to overlook other factors in ultraviolet treatment. In the summer time we find three biologic factors co-operating: Ultraviolet, external heat and an abundant intake of vitamins from fresh fruits and vegetables.

The effect of ultraviolet on Vitamin B we do not know so well. Suffice it to say that we know the effect is of paramount importance in Vitamin D deficiency. We know that ultraviolet does not cure beri beri, and that ultraviolet does not cure scurvy. It is highly important to keep in mind that the effect of an excess of ultraviolet or Vitamin D is harmful in the absence of Vitamin C. It has been demonstrated that in the absence of Vitamin C ultraviolet or Vitamin D becomes toxic, and that if we increase the amount of cod liver oil given a particular animal and decrease the amount of Vitamin C it more readily succumbs to infection. When we administer ultraviolet or Vitamin D in cod liver oil, we at the same time should prescribe a large amount of Vitamin C in the form of orange juice. Please remember that all experiments reported on animals are experiments in which the animal is on a perfect diet and that only one factor has been varied. With sunlight or ultraviolet given an animal under perfect experimental conditions we have wonderful results, but these results we may not be able to repeat on our patients because they may have other deficiencies than the particular one which we are attempting to treat them for. It would, therefore, be of interest to bring about in the patient adequacy in diet and physiologic rest in order to increase the benefits of any regime of physical therapy. In this connection it is of interest to recall the statement of Dr. Carl Sonne, our distinguished guest, that all possibilities must be taken into consideration in order to arrive at a proper evaluation of biological methods.

Before passing I wish to congratulate Dr. Lake on the comprehensive and thorough grasp of the field which he has covered this morning.

We now come to Dr. Dorne's paper.

The effect of ultraviolet on the red blood cells has been under investigation for a long time. Barenberg in 1893, Martin in 1897, Morrison in 1900, Orsum in 1906, Koster in 1920, Moran in 1924, Hill and Moran in 1925, and Sanford in 1928, all have worked on the effect of ultraviolet on the hemoglobin content of the blood and also on the erythrocytes and leukocytes.

The results more or less vary, and they vary for several reasons. In the first place, ultraviolet in itself is not the only factor required for building hemoglobin and blood cells. In order to build red cells and hemoglobin we must have at our disposal several other factors. We must have iron and we must have the stroma building material which Whipple and Robscheit-Robbins recently discovered and which Minot and Murphy so effectively applied in the treatment of pernicious anemia. When we apply ultraviolet we find that some patients will show an increase in hemoglobin, some a decrease and some neither an increase or decrease. When we treat an animal with ultraviolet but fail to make good a deficiency in calcium or phosphorus, it would be doubtful whether a good deal of bone is formed. It would be a good suggestion, therefore, to include in an experimental piece of work designed to show the effect of ultraviolet on blood regeneration and adequate intake of iron-containing food and stroma-building foods. In this way perhaps some of the variations would be eliminated, and we would likely have a more uniform and happier series of findings.

In connection with the red cells, I wish to point out some findings on the white cells. The white cells are of particular interest in view of their ability to protect the animal from toxemia of all sorts; and the white cells, therefore, have received a good deal of investigation and discussion. White cells have been studied under the carbon arc lamp by Larson, and under the quartz lamp by Berner, Aschenheim and Martin. It has been studied by other men, but more recently by Murphy and Sturm and by Dr. Carl Sonne.

Murphy has studied the effect of the ultraviolet on white rats, and he has found that at first there is a decrease in the polymorphonuclear leukocytes, followed afterward by an increase until, at the end of eight days, the "polys" become normal. At the same time the mononuclear leukocytes increase from two to three weeks. Investigating a little further it was found that during this period of increase, the animal is less susceptible to tuberculosis and also less susceptible to cancer implantation.

Dr. Sonne has worked in this field with reference to the influence of luminous rays. Re has used the guinea pig and the rat. He has found by using guinea pigs that there is first a decrease and later an increase in leukocytes.

Dr. Sonne has found that the normal rabbit has a leukocyte count of about 7,000 and a "poly" count of 30%. Giving luminous energy, he observed that the count was reversed. At first the "mono's" decrease until finally there is a picture of a large increase of the "polys," and relative decrease in the lymphocytes. In other words, if a normal rabbit has seventy per cent mononuclear leukocytes and 30 per cent polymorphonuclear leukocytes the figures are reversed within forty-five minutes after subjection to irradiation.

These varying findings reveal to us the importance

of time relationship. We may record observations on our experimental subject at a time when there is a decrease in the lymphocyte count; we may observe time when there is a decrease in the lymphocyte count; we may observe him when the count is normal; we may get him at a time when it begins to increase. Therefore any series of results in order to be comparable must take in the time of observation as an important factor. It is very possible that when we analyze these tables on the basis of the time of observation we might get conclusions that are wholly different.

And now we have the extremely pleasurable opportunity of discussing the excellent paper of Dr. Carl Sonne. Dr. Sonne brings to us several important lessons: one is the thoroughness with which the European investigators go through a problem. We in America publish too many articles. We cannot but show great admiration for the thoroughness with which Dr. Carl Sonne attacks a problem of research. Another important lesson that Dr. Sonne brings home to us is that a man who is so thoroughly immersed in science as he is can yet find time to be amiable and pleasant and versatile.

I shall say with the kind indulgence of the Chairman, a few words about this particular paper of Dr. Sonne's. Mineral metabolism lies at the bottom of many pathological conditions. Especially is this true of the metabolic processes underlying a deficiency in calcium, phosphorus and iron. This field of metabolism occupies a very prominent place in the life of a child during its formative period. Rickets, tetany, poor teeth and anemia are manifestations of some of the many derrangements in mineral metabolism. Calcium, of great importance, seems to have a mechanism of its own for its absorption and assimilation, and therein lies the biologic importance of ultraviolet rays and natural sunlight.

Dr. Sonne in his address today and in many of his published researches shows on irradiation that phosphorus and calcium are increased in the blood. Dr. Lake has pointed out to you that ultraviolet should be given with calcium therapy and that the calcium is absorbed more thoroughly on an empty stomach or in the presence of sugar like lactose. This goes gack to the important principle that cod liver oil has an effect of increasing the gastric acidity and consequently increasing intestinal acidity. Lactose is another method of developing more lactic acid in the intestine. Sunshine and also ultraviolet increase the gastro-intestinal acidity and allow the calcium salts to remain in solution; and remaining in solution they have a chance to be absorbed and utilized in the production of bone and in other important chemical and physiological processes.

Dr. A. Bachem (Chicago): I should like to start with a general remark and say that up to the present time most of the biological investigations and researches seem to be rather inconsistent or contradictory, and if clean-cut results have been gained, logical and correct explanations usually were difficult to obtain. Therefore those excellent papers, those clear presentations that we heard given by Dr. Lake and Dr. Dorne and that excellent presentation described by Dr. Sonne are of tremendous value.

I should like to ask the physicians to stick to the problems which have been mentioned in these three papers.

Dr. Lake talked about the dosage, and from his description I think we should see how complicated the problem of dosage still is, although he says that a quantitative dosage is arrived at the present time. This is the only point in which I disagree with Dr. Lake. It seems to me that the problem of dosage in ultraviolet is not yet as far advanced as it is at the present time with the x-ray.

In this connection I also should like to contradict Dr. Levine's conception of omitting the physical dosage and replacing it by the biological dosage. We have to have exact quantitative physical dosages. We see this particularly in x-ray work.

About three to five years ago, when we were still lacking in proper dosages of x-ray, we could not compare two machines with each other. We did not speak the same language practically, and we didn't know what we were actually doing until we found out by our biological results weeks or months later. That has been overcome by the work which has been particularly done in Germany by the creation of a universal measuring device, which we have at the present time, and everybody is now enabled to measure his own apparatus to determine physically what he does with his x-ray machine.

So far as our ultraviolet is concerned, it seems to me that we are about where the x-ray was three to five years ago. We cannot yet compare our apparatus. We cannot compare even our ultraviolet lamps of half a year ago with those that we have now at the present time after they have been in use and have deteriorated to a certain extent.

Therefore, we should effect some definite, workable understanding and finally arrive at a universal unit. In this connection, I should like to ask Dr. Sonne what he, as one of the outstanding research workers, thinks about such a physical unit, whether it should hold forth for the whole range of visible ultraviolet and infra-red light, namely, that the energy in terms of calories is given in the spectrum or for those special parts of the spectrum which are effective in rickets and erythema production, and whether special apparatus like the cadmium cell should be preferred.

As a second problem I should like to touch upon the one of penetration because this has to do as well with the effect of light upon the blood stream, and too, as Dr. Sonne showed, a very marked effect upon rickets.

I was not able to present a paper at this meeting on account of just coming back from Europe, but I gave a short outline of my paper in Stockholm and I showed some slides which seem to me to give the proper distribution of ultraviolet light through the unit scheme.

The research of my experimental work differs from that of Hasselbach in so far as they give greater penetra-

tion inthe skin end and from the newer work of Macht and his co-workers in that the penetration is much smaller.

I should like to ask Dr. Sonne whether these figures correspond closely to the ones that he considers as correct and a direct opposite of Dr. Hasselbach and others and what conclusions we can draw as to the antirachitic effect and where the effect takes place.

Finally, we might come to a conclusion as to which part of the spectrum is especially attracted to the blood stream because the far ultraviolet doesn't reach the blood stream and it is only the near ultraviolet that influences it, but of course with the aid of infra-red.

I should like to congratulate the College of Physical Therapy for these three papers that we had the honor to hear this morning.

Dr. N. E. Titus (New York City): I wish to bring two points to your attention regarding dosage.

This summer I saw Professor Turrell at Oxford and he showed me a biologic method of dosage that he has been using for some time which he will publish this fall. I asked if I might speak about it in this country and he said, "Certainly."

He takes a piece of paper with a small hole about the size of a quarter in it and puts it over the patient's arm, and then using a dark Crookes B lenz in his own glasses he watches the skin for a few seconds, and suddenly there is a red burn coming over the skin which with the Crookes B lenz looks black. At first a sort of gray tinting may be seen and then there will be a darkening of that very quickly. He uses that for a certain amount of time, and times it with a stop watch. He uses that amount as the index for a mild erythema dose. He employed it on me a number of times and it does seem to work. The erythema forms in about twelve to sixteen hours, and it will remain for twenty-four hours. He says that in an effort to get at a proper dose such a method is a matter of choice. He uses a Crookes B lenz with a small opening in a piece of paper, treating a part of the skin until he gets the sudden blush of the skin as revealed by the Crookes B lenz.

We have to come to some biologic means of determining dosage, and the method that Dr. Turrell used is something that may be used for determining the total amount of ultraviolet exposure that may have the desired effect in the treatment of the individual.

Dr. George B. Lake (Chicago): In regard to the biologic figuring of dosages, I think that Dr. Dorne's talk and Dr. Sonne's talk is very convincing to anybody who listened carefully that these biologic effects are still in such a chaotic condition that they are not susceptible of being used as an accurate index of gaging the red corpuscles and the hemoglobin in increasing or decreasing amounts.

The whole basis of this business is individual applications. Different persons do not react in the same way to equal doses of ultraviolet radiations or many of these other things.

Another thing, I think that we are not yet in a position, although we can estimate in interesting figures, to say that a man gets thirty minutes of exposure to the sun's rays in the summer time with a certain effect on the body. I think we are a long way from being in a position to say that ten minutes of exposure to a certain ultraviolet source is going to produce the same effect as a certain number of minutes exposure to the sun's rays. Those are all interesting speculations that have as yet not been converted into facts.

One of the doctors expressed an opinion indicating that the subject of dosage of ultraviolet or other phases of the general treatment of disease can be settled. As a matter of fact, nothing is ever settled. There is not a proposition that we know of and consider a scientific fact which could not be entirely done away with by just one negative finding. I have said that over and again; no amount of experimentation can prove that I am right, because at any time someone may perform an experiment that will show that just one of my conclusions is missing and therefore my whole theory is contradicted. Nothing is yet settled or ever will be as long as the human race is continuing to evolve.

I merely endeavored to give you what I understand about the present status of the dosage of ultraviolet radiations. If we do not use the knowledge that we have intelligently and continuously, we are not going to be in a position to use any new knowledge when it appears. That was my point. I only endeavored to give you as nearly as I could the present status of the administration of the ultraviolet radiations.

Dr. Titus' suggestions are extremely interesting. The only trouble with Turrell's idea is of course that we work that out on each individual, but with a quartz mercury lamp you would have to work it out every time you treated a patient because the lamp varies from time to time and to a certain extent of itself.

These things are all extremely interesting; they are all pointers in the direction in which our investigations will, I believe, proceed, but for the present it seems to me that the only thing that comes anywhere near a standard method of dosage is by physical measurement.

Dr. Carl Sonne (Copenhagen, Denmark): There was first something said about the penetration. I think experiments regarding penetration are something very difficult. I am sorry that I could not clearly understand the table of Dr. Bachem. I should be very interested to see the experiments more closely.

When you take the skin of a body and lay it on the photographic plate and then place a spectrum over the skin you will perhaps get a photograph of some length in the spectrum through the skin, but in some cases I think some of these lines are not right. There has been in the skin some fluorescence, and in some cases it is not penetration through the skin but through the fluorescence of the skin.

I have also seen these penetration experiments by Macht. I think perhaps that my experiments, to some

degree, show you what penetration there is, what is meant by penetration, when you have figured on your erythema.

The foregoing chart inclines me to believe that the rys at 3,000 had a good penetration, and there is another good penetration at about 2,800, and again some better penetration at 2,600. The reason that there is not such a good penetration at 2,800, I think, is because the absorption of the ergosterol is best at about 2,800, and ergosterol is also perhaps quite near the surface of the skin.

This shows that with rays at about 2,800 there is absorption and no irritating effect can be produced. It is a curious thing if it is right, and I believe it is right, because it means that the best effects with rickets are given by rays that are less absorbed.

There was something said about dosage. It would be a very good thing if we had some dosage meter for ultraviolet rays. When we first know which wave lengths are best for those special diseases, I think it will be quite easy to make such a dosage meter, but at present we don't know which rays are the most effective in the treatment of special diseases, and for that reason it is not easy to make an instrument to measure them. In all events, I think it will not be easy to make an instrument that we can use in all cases of diseases. I think in some cases some rays are best and in other cases others are best, and in still others perhaps a combination. We don't know just yet what is the best.

THE VALUE OF ULTRAVIOLET IRRADIATION IN DENTISTRY*

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Present day dentistry and medicine are in accord as to the interdependency of one to another. Both deal with living tissues in various states of disintegration. And while dentistry, heretofore, has leaned heavily on mechanical or prosthetic measures to remedy certain changes in the oral cavity, it has nevertheless based its studies on the same pathophysiological fundamentals as medicine. Degenerative processes, whether found in the mouth or in other cavities, are subject to the same laws of change. The physiology of the cells and the circulation in the oral cavity is the same as found in other tissues, and treatment or restoration should be based (and in reality is) upon the same broad principles as in medicine. Any innovation or advance in therapy is therefore of great interest, even though it may be restricted in its scope, to the dental profession.

The results of local ultraviolet irradiation in certain affections of the oral cavity have been investigated in various clinics. A close survey of the literature indicates a wide enthusiasm for the measures employed, with the conclusion that local irradiation is of great benefit, either alone or in combination with other agents. Frequently the conclusions advanced by some of these investigators are justified by the results obtained. In many instances, however, a critical study of the reports indicates a lack of control measures and hardly justifies the optimism displayed. Facts and fancies are frequently found to be intermixed. The dentist's conception of the value of ultraviolet irradiation relative to oral affections is therefore somewhat clouded in places as the information is often not based on scientific facts. Theoretically, before any conclusions can be drawn as to the utility of ultraviolet irradiation, a short resume of some of the factors involved in its application is clearly indicated.

The dentist, unlike the physician, is interested in only a fraction of the ultraviolet spectrum, that generated by a water cooled mercury quartz burner. This unit by virtue of its heat absorbing quality, can be brought in direct contact with living tissues by the interposition of quartz applicators Only the ef-

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fective shorter frequencies, such as the middle and far distant ultraviolet rays, are utilized in water-cooled units. These rays are diametrically opposite in their physiologic effect to that of the near ultraviolet as found in an air-cooled unit. These short rays act as biologic depressors; they are toxic when used intensely over a large area and over a long period of time. General metabolism is depressed under this form of irradiation; tissues are stimulated, and even protein coagulation or necrosis may take place. These short rays are both bactericidal and cytocidal, and definitely influence the protein particles of the cell.

The change in tissue invariably parellels the law of absorption, and its effect is as selective for tissue cells as it is for bacteria. It must be remembered that no photochemical or actinic effect can take place unless the energy is absorbed. Indeed, this is a point worth stressing, as the literature generally emphasizes the penetrating and the bactericidal effect of the far ultraviolet region, and omits to point out the important quality of its cytocidal and tissue stimulating value. Therefore the outstanding quality of ultraviolet irradiation is its power to be absorbed within tissue. The organic material is activated according to the type of radiation and the degree of energy that it absorbs. If absorption takes place within physiologic limits, tonic and oxydizing reactions follow. This is in accord with the known facts of tody as to the qualities of the near ultraviolet region. If the type of radiation absorbed is beyond physiologic limits, depressing effects ensue. Locally this effect is manifested by tissue necrosis, blistering of the gums, and, not infrequently by a general feeling of malaise. The fundamental concept of ultraviolet irradiation whether local or general, is first that energy is absorbed, and second, that the effect of the energy absorbed varies inversely with its frequency and its intensity.

Another factor that precedes radiation absorption and is of equal importance in therapy by water cooled ultraviolet, is the power of transmitting these rays. Some of the factors in radiation-transmission of a water-cooled unit, are the quartz burner, the quartz window and the quartz applicators.

The dentist at the present time frequently encounters a decided variation in the reaction obtained on practically the same localities on different patients with similar applicators. Bovie has called our attention to the fact that the transmission of the energy through similar applicators may vary out of all expected proportions, and that it is more of an accident than the rule when two identical applicators transmit similar degree of energy. This is an important factor and can be rectified by calibrating and measuring its transmission power before they are sold to the profession. Treatments thus given would be more precise and the results decidedly more uniform. In spite of the lack of uniformity in the mechanics of the apparatus and the variability of the quartz material, good results have been obtained in many cases. This clearly indicates that we are dealing with a potent energy which is not fully understood, although appreciated.

The technic of application of this energy is of no less importance than the understanding of its fundamentals. The best results are obtained in selected cases. A precise technic will often give results in a majority of cases, whereas a careless one will often spell failure.

The preparation of the mouth, prior to treatment, is of utmost importance. In treatment of pyorrhea, the teeth should be thoroughly scraped and polished; and since this operation usually leaves the gums in a bleeding condition, it is suggested that this operation be performed at least twenty-four hours prior to irradiation. The use of astringents at this time is permissible. Prior to irradiation the part to be treated should be cleaned with a solution of caroid. This is a digestive ferment and dissolves the protein material and tenacious mucin which is usually present. The value of this procedure is apparent. It removes any foreign material from the field that is to be irradiated. It prevents absorption of the rays by any other material than that which is to be treated. Its value is apparent when it is remembered that the penetration of these rays is less than 1 mm. in

depth and that the film present would thus prove an obstacle of no small proportion.

The quartz applicators should be of the clearest make. Frequently one sees applicators with many bubbles in the body of the quartz. The transmission value of such applicators is decidedly diminished. To compensate the use of such applicators the treatment time must, of necessity, be doubled or trebbled in order to obtain the same results as with clear ones. The severe discomfort and general intoxication that often follows the wholesale irradiation in many pyorrhea patients has influenced us never to treat more than one or two and rarely three teeth in one sitting. It is decidedly better to treat a few teeth with the greatest thoroughness, rather than spread a mild application over a large area.

The effect that is most desired in pyorrhea is one that produces the greatest tissue reaction. Following the absorption of the energy the mucous membrane is definitely traumatized. After a latent period there is progressive bleb formation and serous exudation. A cross section of the treated tissue now shows round cell infiltration, leukocytic and lymphocytic invasion, with debris of dead bacteria. Progressive exfoliation of the dead material follows and nutrition is materially increased because of the active hyperemia produced. The gums gradually become harder and the inflamed, red appearance is replaced by a normal healthy pink color. Gum recession is stopped and very often there is a noticeable hyperplasia or regeneration of the tissues. The teeth become fixed and firm. However, this fixation depends upon the extent of the destruction previous to treatment, for one can hardly expect to restore extensive recession in advanced cases. Such results from local ultraviolet irradiation can only be expected in early and moderately advanced cases.

The greatest field of usefulness, however, is to be found in the large group of subacute and chronic gingival cases and in affections of the gums that act as forerunners to pyorrhea. The modern trend of therapy, both in medicine and dentistry is in the field of prevention or prophylaxis rather than cure. In this circumscribed field (the oral cavity) local ultraviolet irradiation is specific in the good results that can be obtained. Its bactericidal properties can be utilized in the early and incipient infection of the gums. Its tissue stimulating qualities and its hyperemic properties are used best in cases of chronic inflammatory process of the gums. Prevention of certain types of pyorrhea, especially the early cases, is possible and can be assured in many cases. These types require the same care in the preparation prior to irradiation, but the therapy should, of course, be less drastic. Stimulating effect is sufficient, and is comparable to a second degree erythema in general body irradiation. This form of treatment promotes tissue oxydation, rather than depression of function. Local sterilization of tissue ensues, due partially to the bactericidal qualities of these rays, as well as the increased phagocytic action brought about by this so-called biologic inflammation. The feeling of increased local vitality that is usually experienced within a few weeks after treatment, is due more to the sterilization of any focal infection, rather than the specific tonic effects of these rays.

Limitation of time will not permit a more detailed survey of the value of this therapeutic agent in many of the specific affections of the mouth, such as acute gingivitis, alveolar abscess (incipient and chronic), pulpitis, stomatitis, postoperative irradiation, delayed dentition in children, etc.

CONCLUSIONS

1. The beneficial effects of local mouth irradiation are due to the utilization of the middle and far ultraviolet region, obtained from a mercury in quartz, water-cooled unit.

2. The transmission powers of present day quartz applicators vary in intensity and indicate an obvious need for standardization.

3. The effect of local ultraviolet irradiations is due to an absorption of energy by the tissues and not to penetration.

4. Its action is photochemical, bactericidal and cytocidal.

5. The beneficial results obtained can be greatly augmented by a precise technic.

6. Local ultraviolet irradiation has a wealth of therapeutic possibilities in oral affections.

DISCUSSION

DR. DISRAELI KOBAK (Chicago): I have listened to this paper with interest and deep appreciation. The essayist did not mince words but gave us a frank and critical survey of the relationship of ultraviolet radiation in certain dental affections. He was specific in his definition of the value of these radiations in dentistry, and indicated some of the theoretical fallacies. It truths, usefulness, and applicability were no less frankly discussed. An important point brought out was that the transmissability of quartz applicators may greatly vary, and that a sharper standardization of these applicators is needed. The utilization of the applicators is needed. The utilization of caroid solution prior to irradiation is a valuable suggestion. It is obvious that anything that helps to improve the penetration possibilities of the short ultraviolet rays is a great aid in the treatment of oral affections.

DR. FRANKEL (St. Louis, Missouri): I should like to say a word with reference to some work done by Dr. Weston Price with ultraviolet. Dr. Weston Price has, through his association with the American Dental Research Association, established conclusively that caries and dentition are definitely effected by the use of ultraviolet light. This was done with general body radiation.

I happen to be a dentist myself, and while I believe that the water-cooled lamp is the field for the dentist, I also believe that the air-cooled lamp is valuable in our field. In this respect, if ultraviolet has this definite effect upon dentition, then the dentist should recommend the use of ultraviolet.

Now the question is whether the dentist should recommend its use by himself, or by the physician. I don't care to answer that question, but I believe that it should be turned over to the physician, because he has the better opportunity to take care of them.

There has also been some local work done at Washington University at St. Louis. Dr. Brady, who is dean of the school, has done some very interesting work on Vincent's angina. The good results that he has obtained have been very startling.

I just mention a few of these things, because ultraviolet in dentistry is really in its infancy.

THE CLINICAL SIGNIFICANCE OF SPIROGRAMS*

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Many of the vital phenomena in the body could never have been satisfactorily studied and understood had it not been for the possibility of representing them in the form of drawings, diagrams, tracings or graphs of some kind. Any activity which can be represented by a graph either directly from moving parts, or indirectly from plotted analytical data, will often clearly reveal not only the very existence of some phenomena or even a function which otherwise perhaps would have remained unsuspected, but also, often in most significant minute details and quantitatively, the characteristics of a function and possible departures from the recognized normal. Cycles in the function of various organs have been in a like manner analyzed successfully and as a result most important means in the field of clinical diagnosis have been established.

Cardiography offers a most beautiful illustration of the astonishing results which are obtainable through the graphic method of study. The cardiograph, the sphygmograph, and the plethysmograph head the list of the numerous instruments which have been and are yet of inestimable value in the study of circulation and in the diagnosis of circulatory disorders. More remarkable still is the electrocardiograph which has not only brought considerable refinement in methods of study and diagnosis but has also revealed the character, sometimes the location of certain cardiac disorders and to some extent the degrees of their seriousness. That such kinds of apparatus are today absolutely indispensable in clinical medicine is fully recognized.

The subject of this paper deals with the function of respiration. Its study has also called into existance and use graphic instruments such as the pneumograph, the pneograph, the spirograph etc., which have proven to be indispensible in the physiological laboratory. Not one of these instruments have as yet been given a place in the equipment of the clinical laboratory ex-

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cept in those of a very few investigating specialists. The value of the determination of the "Vital Capacity" by means of the spirometer is being gradually recognized. As a rule, however, this is accomplished without the necessity of a graph.

A new era in spirography has been introduced in clinical medicine in the widespread adoption of the writer's graphic method of estimating the basal metabolic rate which he has strongly advocated as the method of choice since 1922 (1). The writer made the following statement: "Aside from the specific application of the graphic record to the measurement of the metabolic rate, the study of the respiration curve should prove to be of clinical interest. This has been shown by Dr. David L. Edsall who has taken advantage of the great wealth of material accumulated at the Carnegie Nutrition Laboratory in Boston to make there a clinical study of respiration" (2).

As material accumulated, a systematic inspection of the numerous graphs obtained confirmed the idea that an extensive study of respiration types, correlating them with all the clinical and laboratory findings available, should prove useful.

The advantages which the Battle Creek Sanitarium Clinic offered for such a study are unsurpassed, chiefly, the liberal use made of the basal metabolism test together with the thorough and extensive routine examination to which every patient is subjected. Material obtained since 1922 only was used because for some time previous the graphic method was not generally used in our laboratory and because still earlier (1913 to 1917) although ten thousand graphs had been made, the corresponding clinical data then obtained is not as complete as it has been since because of the adoption in the routine examination of several newer laboratory tests. The present study has therefore been limited to the twenty thousand or more tests made since 1922.

After considerable study definite classification of respiration types was adopted. This was based purely on the various characteristics disclosed in the spirographic tracing of inspiration and expiration, the two phases of the respiration cycle. As obtained by the spirograph, this curve indicates the manner, rapidity and degree of lung inflation or deflation during these two distinct active periods, and also the presence and duration of the intervening rest period.

One would naturally wonder whether there could not be as much significance to the details of a spirogram as there is to those of a cardiogram or sphygmogram. The latter types have for many years been indispensable to the clinician in diagnosis. Incidentally by harnessing the cardiac muscle currents as is done by means of the electrocardiograph, several significant minute details of the component events in the cardiac cycle are graphically registered. Tracings thus obtained are very profitably scrutinized for the possible meaning which can be attached to every line, notch, crook and curve. Pneumograms or spirograms, are, for the time being, seldom if ever called for by the clinician for diagnostic purposes, though by no means ignored in the research laboratory. On account of the peculiar and unfavorable distribution of the muscles of respiration it is doubtful whether electrospirography can ever become useful. Although spirograms are as easily obtained as cardiograms there are reasons why the first have not proven to be as easily interpreted as the latter. Respiration is much more susceptible to numerous variations which are meaningless clinically on account of the fact that, unlike the heart, it is under the control of the will. Furthermore, respiration can readily be disturbed and even interrupted by various reflex influences.

At first sight it would seem that the clinical value of respiratory tracings would be very restricted if not practically useless. Nevertheless, recalling early and generally pessimistic impressions relative to the possible value of practically all of the diagnostic procedures which have been developed during the past ten years or more and which today are in every day use, one is justified in entertaining some degree of optimism in what may in time occur in fields which are as yet quite unexplored.

Spirography is in its infancy, but the work which is here reported should at least give us

hope that sooner or later it will be given a place among the indispensable clinical diagnostic procedures. Spirograms as obtainable in conjunction with metabolimetry could hardly be improved upon chiefly because of the ideal conditions and minute care under which they necessarily must be taken to be of any service for the successful determination of the basal metabolic rate. In fact, I am convinced that by following the proper technic such spirograms will be found, in the near future, to be as reliable for diagnostic purposes as the electrocardiogram. I cannot take time to elaborate specifically on my reasons for this conviction. Furthermore, in view of the results obtained so far, and which are to be briefly reported here, I believe that there is evidence of the fact that in their respective spheres the spirogram is of even greater significance than any other graph obtained so far in clinical investigations. This bold statement is primarily supported by the fact that the type of breathing of any individual is unquestionably a more significant index of the general vital status of the body than any other single clinical factor. Oxidation is the most important biologic process. This alone gives to respiration a very prominent place in the evolution of all living organisms. Many other functions including circulation are subservient to it. Recent biologic studies have revealed the most significant fact that in the evolution of typical organisms from their unicellular origin, the very point where for any reason the respiratory exchange is favored and becomes the most active, determines the subsequent location of the head of the organism. The primordial influence of respiration on the evolution of the living organism and particularly on the development of its controlling mechanism is most significant and more than anything else points to its unique and far reaching influence. The very fact that the higher powers of an individual have a chance, through the will, to influence the development of certain types of respiration, should also strenghten our conjecture that in the manner of breathing, significant characteristics of the individual are expressed.

The writer has been extremely fortunate in enlisting for this study the able cooperation of his colleague, Dr. J. M. Nielsen, associate in neurology at the Battle Creek Sanitarium. With untiring zeal he has persistantly labored, even in the face of many discouraging difficulties, at the task of collecting, classifying and correlating a huge amount of clinical data, with the mass of spirograms available and which the writer had previously classified into nine recognized types. The description of these types and the results obtained as here given have been presented at the Annual Meeting of the American Medical Association at Minneapolis before the section of pathology and physiology, June 15, 1928 (3).

Before exhibiting these types on the screen and calling your attention to their characteristics, a brief description of a normal spirogram, with the aid of the first slide (Fig. 1) will be given. To better bring out these characteristics, this spirogram was taken with a slowly moving kymograph. The pen ascends abruptly during the inspiratory phase, then without any appreciable pause descends during expiration, first quite abruptly, then more slowly, ending with a more or less definite pause before the next inspiration begins. Additional characteristics are better shown in the next slide (Fig. 2). The depth of inspiration varies considerably more than the depth of expiration because expiration is a passive act. A line drawn, or imagined drawn, to

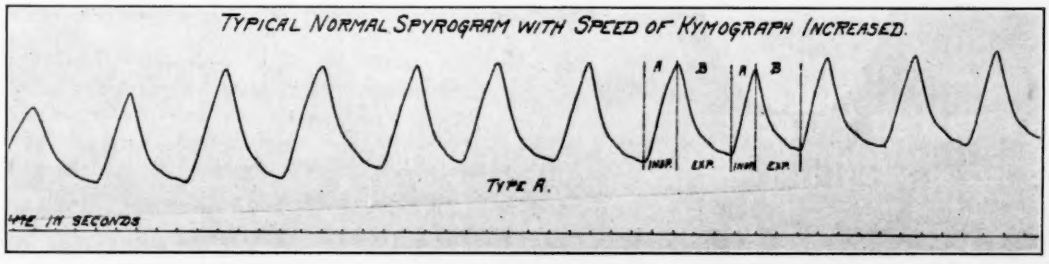

Fig. 1. Normal Spirogram

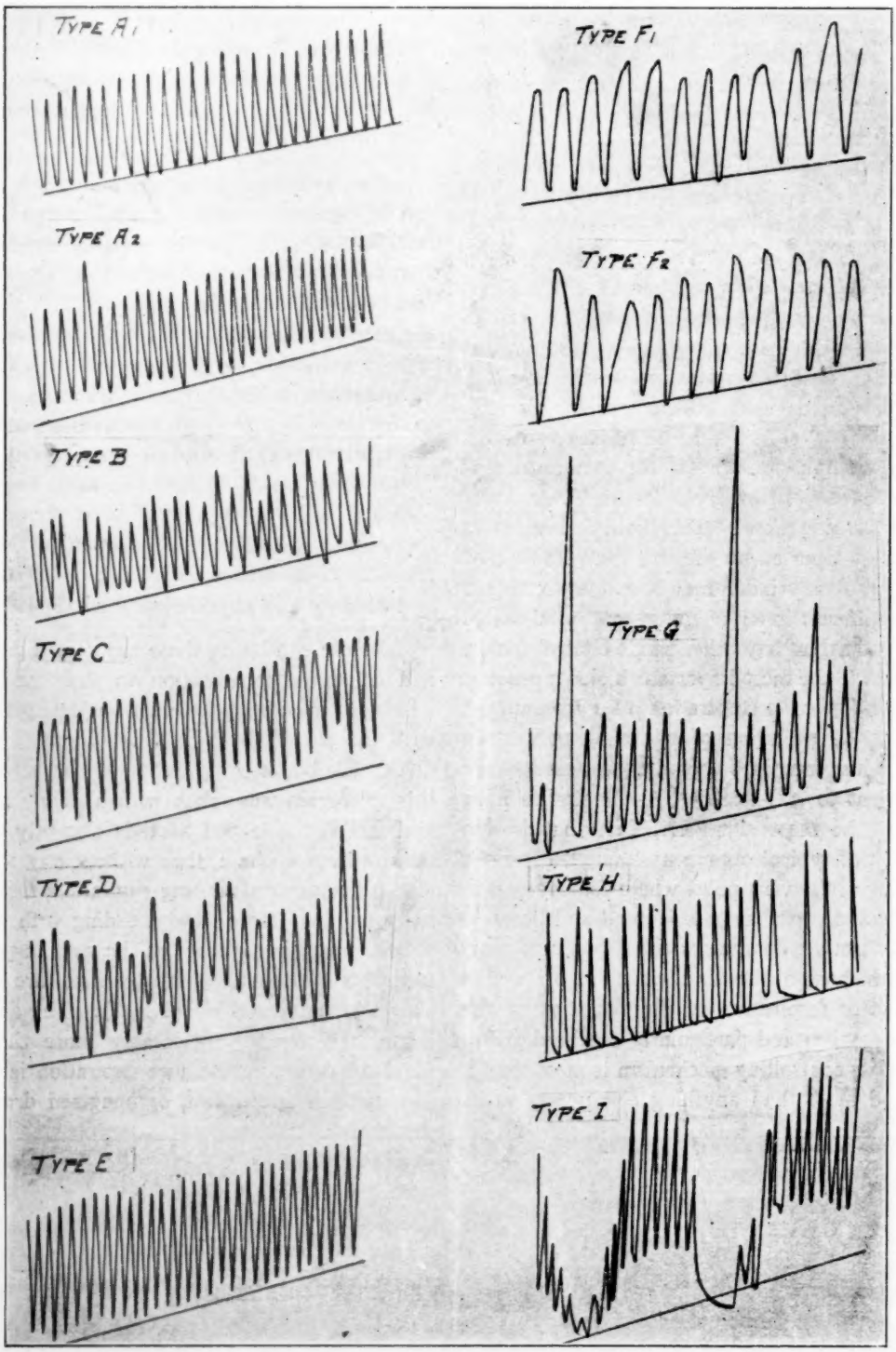

Fig. 2. Diagrammatic illustration of the nine respiratory types here presented. In type H the tracing is not long enough to show the waviness referred to in the description. See Fig. 3.

connect the inspiration apices is called the inspiratory line. This is the upper margin of the tracing. A similar lower margin gives the expiratory line. (The straight line drawn close to the lower margin is entered by a technician for purposes of calculating the basal metabolic rate and has nothing to do with typing the tracing). A normal tracing has a regular and even expiratory line and a slightly irregular inspiratory line. There is a slight pause at the end of each expiration.

Type A is almost identical with a normal respiration. It is characterized by a fairly regular inspiratory (upper) line and a regular expiratory (lower) line. In addition there is a slight pause at the end of each expiration. There are two sub-types (A and A2), the second showing more irregularity than the first.

Type B is determined by an irregular irregularity of the inspiratory and expiratory lines, especially the former. Otherwise it is like the irregular type A (A2).

Type C is an inverted type. The inspiratory line is practically straight while the expiratory line is somewhat irregular. The slight pause in each respiration occurs at the end of inspiration instead of at expiration.

Type D shows a periodic and fairly regular wavy contour in both inspiratory and expiratory lines—ribbon formation. The regularity distinguishes it from type B.

Type E presents a normal general contour but in the individual respirations there is no pause at either inspiration or expiration.

Type F is characterized by a normal general contour but there is a definite pause at inspiration. In this sense it is a reversal of the normal.

Type G has the normal inspiratory line interrupted by frequent and very deep inspirations. The intermediate portions of the tracing are normal.

Type H shows a definite regular waviness in the inspiratory line. In addition there is a pronounced pause at each expiration. Next slide (Fig. 3) is a longer tracing of type H showing more plainly these characteristics.

Type I is the well-known Cheyne-Stokes type. There is a periodicity in the entire contour, a tendency to crescendo and diminuendo in the individual respirations, and a pause at expiration considerably greater than that encountered in type H.

It is not feasible in this brief paper to give the data or all of the reasoning that led up to our conclusions. This will have to appear in detail elsewhere. We shall merely state briefly the general method of procedure.

Two approaches were used in order to avoid the errors very apt to creep into a statistical study. The first was the approach from types to clinical findings, the second from clinical findings to types. In other words we selected first all the cases of one type and determined their characteristics; next we selected all cases of one characteristic and determined in which types they occurred. The cases were divided into constant and inconstant ones according to whether they manifested the same type of respiration in every test or fell into different types in the various tests.

To determine the characteristics of the types only the constant cases were used. These were studied from the stand-points of age; race; sex; state of nutrition; basal metabolic rate; pulse rate; respiration rate; alveolar CO_2 tension and acetone in expired air; lung ventilation in liters per minute; urinary findings: acidity, sugar, albumin, acetone, casts and blood cells; blood findings: cell count, hemoglobin by the Dare Method, Wasserman test, non-protein nitrogen, uric acid and sugar content; and all clinical diagnoses. The incidence of every item was first determined on the normal series and this was used as a control. Unless a condition occurred in any type to such a degree that it differed from the normal by one third it was not admitted as an established abnormality.

A study of the inconstant cases was productive. There were two types of inconstancy, one in which a tracing partook simultaneously of the characteristics of two typical spirograms and cases which fell in one type in one test and in other types subsequently. This gave us a

good insight into the type interrelationships. We found there was a definite association between certain types and apparently an impossibility of association between others. Of 36 theoretical possibilities only twelve actually occurred. This is shown in the next slide (Fig. 4). The most striking feature of this figure is the fact that no patient having a normal respiration can possibly develop a Cheyne-Stokes type (I) unless he first develops type H.

The clinical characteristics of the various types as determined by this work are as follows:

Type A is the normal and serves as the control. It may be the precursor of others when sufficient cause arises to alter the type. It is related to all other types except I. There is hardly a disease process incompatible with a normal type of respiration, but other factors, e.g. puberty or blood chemistry changes, may incur to bring about a change.

Type B may arise by a dynamic process in the endocrines system. Its most common associations are with types A and H. Conditions occurring in this type considerably oftener than in the normal type are: hypotension, neurotic and psychotic states, mucous colitis, and endocrine disturbances.

Type C occurs practically exclusively in women, and hence we believe it is controlled by some unusual function of the female hormone. We are not in a position to make any other statement concerning it because of the paucity of our material.

Type D is largely, though not exclusively masculine (about 88 per cent). But it occurs in young boys as early as they can be tested (before puberty). In this type there is a peculiar mixture, a tendency to endocrine disturbances with both hyper- and hypothyroidism, and also a tendecy to cardio-vascular-renal disease. This is manifested by blood retention of non-protein nitrogen, uric acid, and sugar. Osteoarthritis and obesity also are prevalent in this type, while neurotic and psychotic manifestations and constipation are rare. The associations are with types A and H.

Type E though appearing graphically entirely d.fferent from the former is nevertheless somewhat similar clinically. It resembles type D in retention of N. P. N., uric acid and sugar in the blood and in the occurrence of osteoarthritis. But it differs from D in prevalence of colitis and neurotic states and in the absence of endocrine disturbances. Its associations are with types A and C.

Type F is one of the rare types and has only the one association with the normal. There is a low non-protein nitrogen content in the blood, and obesity is prevalent.

Type G is an important type, practically exclusively female. It develops in certain girls at puberty. Once established it does not dis-

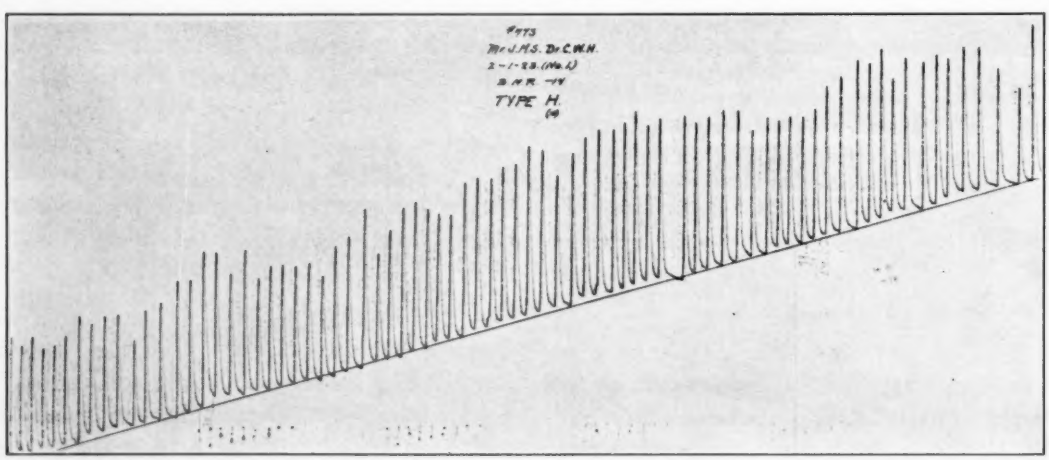

Fig. 3. Spirogram illustrating the wavy appearance of the inspiratory line and the exaggerated pause at the end of expiration, which are the characteristics of type H.

appear at menopause. Hypertension, myocarditis, obesity and osteoarthritis prevail. Endocrine disturbances are quite common.

Type H, the suggestive Cheyne-Stokes type, occurs in childhood but also develops from type A with which it is closely related. It is the inevitable precursor of type I. A high uric acid content of the blood and myocarditis occur in this type. Its associations with types A, B, D, G, and I are numerous.

Type I is the typical Cheyne-Stokes type and develops from type H under certain conditions among which is a high blood uric acid content. We seldom see this type in a woman. It rarely occurs before the age of 50. While the majority of the cases in this type have C. V. R. disease or diabetes, there are some who develop it without suffering with either of the above diseases. They all have increased uric acid content however.

At this point the question of necessity arises whether our respiratory types on the whole are caused by these abnormal physical states. Inasmuch as practically all disease processes occur in the presence of a normal type serious doubt is cast on this point. It occurred to us that we might solve this question by studying respiratory types in children, making use of our patients as early in life as they could be tested. This line of research proved extremely valuable because it was found that types A, B, D, E, F and H may all occur in childhood. In fact we are forced to conclude that the above named types are probably evidence of hereditary characteristics—perhaps an hereditary condition of the respiratory center. If this be the case the preponderance of certain diseases in the types must be merely an associated condition.

To either confirm or deny the concept that the types are largely hereditary a special study of this point was made. Three families were obtained in which the parents and at least four children could be tested. In each of two families five children were obtained, in the third there were only four. A definite inheritance was shown

CONCLUSIONS

I. All people can be divided purely on the basis of their spirograms into about nine types which we have lettered. (A few extremely rare types are still to be studied).

2. Respiratory types A, B, D, E, F and H are hereditary and the occurrence of these types merely presages certain predispositions in the individuals.

3. Types C and G are controlled by some unusual function or influence of the female hormones.

4. Types D and I are similarly but to a more limited extent controlled by the male hormones.

5. Certain individual characteristics and disease processes are shown by this work to be of an hereditary nature. Namely,

1. Cardio-vascular-renal disease.
2. Non-ulcerative colitis.
3. Increased blood sugar, uric acid and non-protein nitrogen content.
4. Endocrine instability in general and specifically hyper- and hypothyroidism.
5. Hypotension.

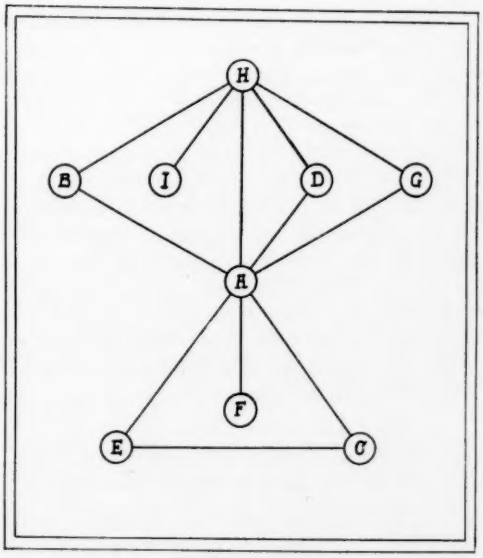

Fig. 4. Diagram to show type interrelationships. One notes the central situation of type A and its connections with all types except I. Types F and I each have only one relationship.

6. Myocarditis.
7. Nervous and mental states.
8. Obesity.
9. Osteoarthritis.

6. Since the hereditary predispositions to certain diseases can be determined in early childhood the application of this work to preventive medicine is obvious.

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DISCUSSION

Dr. J. C. Elsom (Madison, Wisconsin): I want to say, gentlemen, that this paper has been very interesting. It is a new thing, of course, to all of us, and it has been very worthwhile, I think, that Dr. Roth should be given a tremendous amount of approval for his investigations that perhaps may mean a great deal to us.

This is my personal reaction, gentlemen: I tried in vain to discover the remotest definite connection with physical therapy. That may be my reaction only. This is a convention of physical therapists and the topics that we are discussing should pertain to the pertinent and appropriate considerations with which we have use for as physical therapists. This paper, of course, to a meeting of physiologists is admirable, undoubtedly admirable, but we are not here as a convention of physiologists. I hope you don't misunderstand and I hope Dr. Roth doesn't misunderstand because I hold him in high regard. He didn't offer to give this paper; he was asked to read it. I say it is a splendid investigation and extremely interesting, but we haven't time as physical therapists to consider every interesting question. I mean it is out of place, and consequently I cannot discuss it for two very good reasons. One is that I don't know anything in the world about it, and the next is that I think it would be exceedingly unfair for me to take your time in discussing a paper that is obviously unrelated to the pressing problems of physical therapy.

I offer my apologies to Dr. Roth for these remarks, which I hope indeed he takes in no way personal. They aren't; they are offered for the general good of the order.

Dr. Jacob Gutman (Brooklyn, New York): I must take issue with the last speaker. Even if we are physical therapists and interested in physical therapy, only last night at the joint meeting we were all urged to scientific activity and to be interested in everything else that pertains to medicine and not only physical therapy. Therefore, I think the paper of Dr. Roth is in place.

However, I myself agree with the previous speaker in that he doesn't know anything about spirography nor does anyone else because it is an entirely new subject. That's why so much more credit should be given to Dr. Roth for not presenting something that somebody knew all about. Just realize the amount of work involved in delving into 20,000 cases at the Battle Creek Sanitarium, and furthermore comparing each one of these spirograms with numerous laboratory investigations to select the relationship of one to another. For that in itself he ought to be praised and he ought to be appreciated.

We don't know what it is going to lead to. I believe Dr. Roth is going into this thing a little deeper when he uses these spirograms in classifying individuals. If a spirogram expresses the type of inspiration and respiration and the relationship between them, then it actually expresses the method by which it may be stimulated. I think this may be developed into a guide to show us and tell us the extent of the saturation of carbon dioxide in the blood of the system. I see no reason why the future studies which will have to be made in these cases will not be able to tell us not only from the diagnosis standpoint but from this work certain diseases which will be identified in time. Dr. Roth has a lot of work before him.

If he would follow my suggestion I should tell him to study certain curves which occur in asthma, certain curves which occur in tuberculosis and various other diseases of the system, not only pulmonary, but anything that has an effect on the carbon dioxide content of the blood.

PHYSICAL THERAPY CLINICS

DIATHERMY IN PNEUMONIA

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DULUTH MINN.

Pneumonia is one of the most satisfactory conditions to treat with diathermy. The effect of the treatment is to allay rapidly the distressing symptoms of which the patient complains and to produce a marked improvement in the physical condition. We have four patients to present this morning.

No. 72121. This man, age 40, came to the hospital twelve days ago complaining of malaise, dizziness, severe headache, sore throat, chilly sensations, pain in the chest and cough, without expectoration. His temperature was 100.6 F., pulse 100, respiration 24, the urine was essentially negative and the leukocyte count 12,300, hemoglobin 85%. Except for the pain in his chest he was quite comfortable. He had a peculiar heliotrope cyanosis quite characteristic of the influenzal pneumonias seen during the World War.

On physical examination, the attending physician noted a limitation of motion, some impairment of reasonance, many rales and marked bronchial breathing over the left lower lobe. At the end of two days there was no evidence of improvement in the physical condition and diathermy was requested. Large electrodes were used, a block tin posteriorly and a mesh anteriorly. They were each 22x22 C. M. On the first day of treatment 1400 m.a. were given for thirty minutes. On the second and third days 2000 m.a. were given for the same length of time. Ordinarily we use a larger electrode posteriorly than anteriorly in lower lobe pneumonia,but as there was some involvement of the lower part of the upper lobe we used electrodes of the same size, both front and back. This gives a more even distribution of the heat through the lower half of the chest. On the fourth day no treatment given because the temperature had fallen below normal and had remained so for twenty-four hours. Two days later we noted a slight increase in temperature. This is not unusual.

Fig. 1 is the radiograph taken twelve days after admission to the hospital. It shows no evidence of the recent involvement. After discontinuing the diathermy treatments, general ultraviolet ray was given for six days for its tonic effect.

No. 72365. This is a lad nine years of age. He was admitted to the hospital four days ago with a temperature of 102 F., pulse 100 and respiration 35 per minute. The urine was negative except for a trace of albumin. The white blood cells numbered 19,800.

Fig. 2 is the radiograph of the patient made on the day of admission. The area of increased density is undoubtedly a lobar pneumonia with consolidation beginning near the hilum. This point of origin of the consolidation is not unusual in children and, as there is no beginning pleural involvement, the initial symptoms do not include pain as so often seen in adults.

Today the patient is quiet and contented, but on admission he was restless and fretful. He objected to his first diathermy application, but now seems happy to be treated.

This block tin electrode 15x15 C. M. in size was placed on the posterior of the chest supported by a large turkish towel. Folded

until it is slightly larger than the electrode the towel produces perfect contact between the skin and the block tin. It covers much more than the area of consolidation in the lung. This is essential, since not only must the consolidated area be covered but also the area immediately surrounding it. It does no good to treat the center of the pneumonia area and not treat the edges. The normal tissue around it must also be included to assure return of the circulation to normal in the congested area. The mesh in front was much larger, 20x20 C. M. The larger mesh was used to assure us that most of the effect of the heat would be in the region nearest the back, for, if you remember your anatomy, most of the lower lobe lies posteriorly.

The patient's chart shows that the pulse is 88, respiration 20 and temperature 98.8 F. If the temperature is found normal no treatment will be given the following day. We are using 1200 m.a. for thirty minutes once a day. The decided improvement from the treatment on the first day made us feel that one treatment per day was sufficient. Had this little patient been more seriously ill a treatment would have been given each morning and evening.

No. 74353. A girl, age 14, came in day before yesterday at 11 o'clock A. M.

Fig. 3 is a film of her chest made before she was taken to her room. You can see that both lower lobes are involved with what is probably a bronchopneumonia, although her doctor told me that he was sending in a bilateral lobar pneumonia.

The ragged outline of the hazy areas, the lack of homogeneity of the shadow and the bilateral distribution of the lesion prompts me to say bronchopneumonia. Lobar pneumonia is usually unilateral, the shadow it casts is quite evenly dense and it is usually confined to the limits of the lobe. The mode of onset is usually the determining factor in making the diagnosis. If the onset is sudden, it is usually lobar. If it is slow or secondary to another infection as influenze or bronchitis, it is usually bronchopneumonia.

The record shows that the patient came in complaining of cough, pain in the chest, pain in the left ear, drousiness and fever. "One week ago she had malaise, that same night an earache, the next day the ear was opened and a purulent exudate under pressure exuded. Two days later, five days before admission, she had pain in the chest and the day following, cough with expectoration was noticed. Her general condition showed no improvement after three more days so she was brought to the hospital." So from the history the onset covered practically a week and the lesion is undoubtedly a bronchopneumonia.

When she entered the hospital the temperature was 102.4 F., the pulse 132 and the rate of respiration 25. Diathermy was administered at once with electrodes that practically covered the chest, front and back. 2200 m.a. were given for thirty minutes and on the next day, the morning temperature was 98.6 F., pulse 96 and respiration still 25. Last evening the temperature reached 99.2 and today at seven A. M. it was 98. So we shall not treat her today having had practically a normal temperature for twenty four hours, after only two diathermy treatments. The second treatment was given for thirty minutes with 2500 m.a. That was 300 m.a. higher than on the first day. The technicians are instructed to give only moderate heat the first time to avoid the possibility of an accident. After the

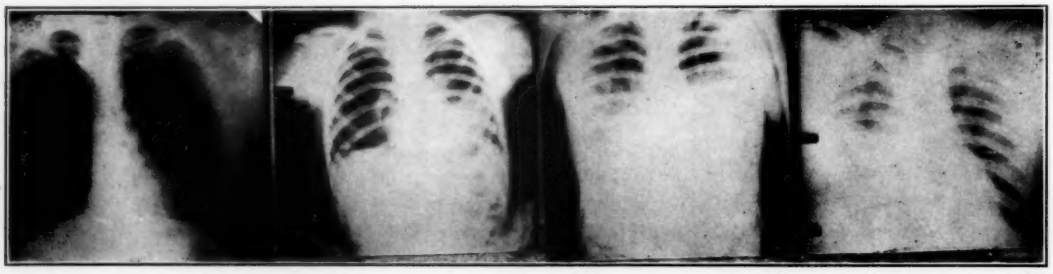


Fig. 1 Fig. 2 Fig. 3 Fig. 4

child becomes accustomed to the treatment higher readings may be used.

In forty eight hours with only two diathermy treatments, this patient has changed from a seriously sick girl with bilateral bronchopneumonia of both lower lobes to one that is practically well.

No. 70945. The next patient, is a well nourished man 21 years of age. He entered the hospital a week ago with pain in the chest, rusty sputum, severe cough and a temperature of 100.6 F. By evening of the same day his temperature was 104.4 F. On the next day it was 105 F. at noon. The third day the maximum was 104.4 F. with pulse of 120 and respiration of 32 per minute.

You can see from the radiograph Fig. 4 that most of the right lung is involved although the greatest density is in the lower lobe. The leukocyte count is 28,700 and the urine examination is negative.

Diathermy was given on the third, fourth, fifth and sixth days. At the end of the sixth day the temperature had dropped to 99 F. Yesterday afternoon it rose again to 102 F. but it is normal this morning. Such a rise for a short space of time is not unusual. On this patient we have used very large electrodes because we desire to treat as much of the right lung as possible. The electrodes are always placed over the hilum area so that the current reaches the lung root through which the blood passes to the lung tissue. On the first day the patient was very restless and only 2300 m.a. were given. The second day of treatment 2500 m.a. were applied. The third day 2800 m.a. were given and on the fourth day, the restlessness being almost gone, 3000 m.a. were given. Each treatment was for thirty minutes. We feel that is long enough, for the tissues, after being once thoroughly heated, probably retain the heat for three or four hours.

Here we have had an extremely sick young man who had been ill for more than forty eight hours before diathermy was applied but in whom the relief afforded from the first treatment was sufficient to warrant continuation of the treatment. With as severe an infection as this man had we would naturally expect the disease to run a course of twelve to fifteen days. But at the end of nine days the patient is almost well. As a rule, we seldom begin diathermy after the forty eighth hour of the illness but in this case the severe nature of the infection warranted doing every thing possible for the patient.

THE ELECTRIC KNIFE

The use in surgery of the electric knife, by reason of the fact that it accomplishes, at the same time, electrocoagulation, is winning more and more advocates. It suppresses all hemorrhage during the operation, except from the large arteries. In reality, this invention is of French origin, having been used by Doyen as much as twenty years ago. But he employed currents of high frequency and of high voltage. The new instruments utilize a much lower voltage, thus reducing the faradic effects to a minimum. Some instruments still produce shocks that are disturbing to the operator, but in the newer instruments this defect has been overcome, to a great extent. Several members have recommended the advantages of the method before the Societe de chirurgie. M. Heitz-Boyer performed a nephrolithotomy entirely with the electric knife, without finding it necessary to place any catgut sutures; he placed merely a few silkworm-catgut sutures next to the drains. M. Gernez performed likewise an amputation of the tongue, applying only a supporting ligature to the lingual artery. M. Proust removed a breast, but a phlebitis of the axillary vein ensued. M. de Fourmestraux has removed, during the past four years, numerous epitheliomas of the face. He has treated likewise cancers of the cervix uteri before performing hysterectomy, eliminating in this manner the causes of the original vaginal infection. J. A. M. A. 92: April 6, 1929.

EDITORIAL

ARCHIVES OF PHYSICAL THERAPY, X-RAY, RADIUM

Eighth Annual Meeting,
November 4, 5, 6 and 7, 1929,
Hotel Sherman,
Chicago.

THE CONTROVERSY ON ARTIFICIAL LIGHT THERAPY IN GREAT BRITAIN

COMMENT

In view of the fact that the controversy initiated by the Medical Research Council of Great Britain relative to ultraviolet therapy is of interest to all medical practitioners who utilize ultraviolet radiation in some form, we have deemed it advisable to take advantage of the courtesy extended to us by the editor of the British Journal of Actinotherapy and Physiotherapy and incorporate in this issue some of the sentiments expressed by various British authorities in defense of actinotherapy. It is pleasing to note the intelligent, prompt and co-ordinated manner with which our British confrers have marshalled their forces and initiated their defense. The sentimental creed of turning the other cheek or the attitude of dignified silence is apparently not a portion of our staunch allies' beliefs.

The defense has dealt some master blows and we await with more than passing interest the reply of the Council. We urge our readers to take advantage of the courtesy extended to them and procure a complete copy of the transactions of this very interesting polemic. In the meantime those impatient for some immediate information may obtain it by reading that which follows, for we have incorporated a goodly portion of this timely controversy for your perusal and edification. —D. K.

ARTIFICIAL LIGHT THERAPY

A REVIEW AND COMMENTARY

(With special reference to the Medical Research Council Report, 1927-28)

The publication of the Annual Report of the Medical Research Council, 1927-1928, containing comments on a report on certain investigations on the value of artificial light, made by Dr. Dora Colebrook, at the request of the Council, came as a bombshell to that part of the medical profession interested in light therapy, as well as the many assistants associated with them. Most serious reflections were made on hospitals and authorities who had the temerity to believe in a form of treatment which apparently does not commend itself to the Medical Research Council.

It seems hardly fair for an authoritative body like the Medical Research Council, without the slightest warning, and on such scanty evidence, to launch an attack where, as they admit, "large new commercial and professional interests are involved."

Fortunately the object of the attack can stand on its own legs, and is in the long run unlikely to be seriously affected; the Council's bombshell may be, after all, only a squib. Most new treatments can be left to themselves. If treatment by artificial light is good, not even the Medical Research Council will shake it; if not, it will fizzle out gradually, and be consigned to the limbo of medical failures—where some notable predecessors (such as the defatted vaccine which was to cure tuberculosis, and the alleged discovery of the cause of cancer) fathered by the same Council, will keep it company.

It is of course, impossible to criticize in more than general terms the actual experiment by Dr. Colebrook on which so much of the report is apparently based. *En passant,* it is to be re-

gretted that the Medical Research Council should have taken the unusual course of publishing what purports to be a considered report based on experiments whose details are not yet available. This is an undesirable innovation in scientific argument, and raises a suspicion as to whether it was not done purposely so as to draw the teeth of the opposition. However, the experiment will doubtless be reported in due course, and will be awaited with all the more interest. Saving our comments on that experiment for the future, let us consider some of the observations made by the Council in the present Report.

In their opening remarks, artificial light is described as a *new* mode of therapeutic treatment. The correctness of this depends on the meaning of the word "new." Looking back a little, we find the first mention of sun treatment by Hippocrates during the fifth century B. C. Since this period there has been a steady flow of heliotherapists. This, of course, will be considered no argument of its antiquity, since the natural sun is referred to; but modern artificial light treatment is based entirely on the properties of sunlight, and would never have been used unless it possessed some, at least, of these properties.

Coming to modern times, Downes and Blunt, in 1877, first made the discovery that rays of short wave-lengths could kill bacteria, and it was on this knowledge that Finsen, a decade before the opening of the present century, started modern actinic therapy by using natural sunlight passed through lenses containing a weak solution of sulphate of copper to eliminate the heat rays. He was followed by Bernhard in 1902, and Rollier in 1904, and so ends the first chapter of heliotherapy.

MODERN LIGHT THERAPY

Modern artificial light therapy began about 1893, when Finsen substituted the carbon arc lamp as a source of ultraviolet light, since he found the sun in Copenhagen was a very unreliable source. Then followed the iron and wolfram arcs, Nagelschmidt's mercury-vapour arc developed by Bach, and the Simpson light. The mercury-vapor lamp has been studied and used mainly in Germany, while the carbon arc in various forms owes its development to the Copenhagen school under Axel Reyn.

The mercury-vapor and the carbon (plain, cored, tungsten, etc.), arc are now the two main types of lamps used as artificial sources of ultraviolet light. The therapeutic application of these various sources has been the subject of intensive study on the continent, in Germany, France, Denmark, etc., in America, and indeed in almost all civilized countries. The literature which has sprung up dealing with every aspect of the subject can only be described as colossal. Extravagant claims for it have been made, but in the main only by certain persons or a few of the firms commercially interested in the sale of lamps and *not* by serious workers. It has certainly been tried on an enormous variety of diseases, but this has been done as a necessary part of scientific progress, not only to prove its applicability, but to discover its limitations.

The first place in which light therapy was strongly taken up in this country was at the London Hospital, where "Finsen light" (local) treatment of lupus was begun early this century. General light baths were added in 1922, following the Copenhagen example. The long experience at this hospital stands as irrefutable evidence of the value of the treatment. Today the number of patients being treated at the London runs in hundreds every week, and it has been stated by Professor Sequiera and Dr. O'Donovan that:

"We agree with Reyn that a combination of local and general light therapy carried out with proper care in the details of the technic will raise the cures in lupus vulgaris to 90 per cent."

For independent confirmation of the value of light treatment in lupus, we can quote Sir Norman Walker, in the 8th edition of his textbook on skin diseases, in which he says:

"I feel bound to say deliberately that under no other method of treatment have I seen such rapid and satisfactory improvement as in those treated by one or other of the sunshine lamps."

EXPERIENCES AT ALTON

Another place where both natural and artificial light have been used as a factor in treat-

ment for many years is the Lord Mayor Treloar's Hospital, at Alton, Hampshire, with its branch establishment on Hayling Island. The successful results obtained in those places have been one of the greatest influences in drawing attention to the value of light therapy in Britain. Sir Henry Gauvain, the distinguished medical director of the hospital, has repeatedly stressed the important part which light plays in the treatment at Alton. He has never omitted to emphasize that it is only *one part* of the scheme of treatment, but has stressed the invaluable role it plays. In a paper read to the Section of Electrotherapeutics of the Royal Society of Medicine on January 21st, 1927, Sir Henry made an interesting suggestion regarding the value of varying the intensity of the light during the course of treatment. In concluding, he referred to the fact that "all observers have been struck by the valuable psychological action of light as evidenced by the cheerfulness and vivacity of the suitably insolated subject. Light is a tonic both to the mind and to the body, and its effect in stimulating mental activity is one of the most interesting and not the least valuable phenomena associated with the complex fascinating sequelae following light therapy in surgical tuberculosis." This is fully confirmed by other observers.

EXPERIENCES IN LANCASHIRE

The last few years have witnessed a rapid extension in the use of light treatment. Taking the county of Lancashire as an example, two experimental "light centers" were established under the Central Tuberculosis Officer in 1925. The results proved so satisfactory that the county council, with the approval of the ministry of health, decided—

(a) to establish up to 15 light centers at county tuberculosis dispensaries;
(b) to augment the staff; and
(c) to defray the fares of necessitous patients attending light centers.

Lest it should be thought that such proposals involved the expenditure of public money on an idealistic rather than a strictly practical basis, the following passages from Dr. Lissant Cox's second special report on the treatment of tuberculosis in Lancashire by artificial light should be noted (the italics being ours):

"The work at the three light centers where patients were treated in 1927 has confirmed previous experience that a number of non-pulmonary cases of tuberculosis which should otherwise be sent to institutions for residential or outpatient treatment, *can be treated at dispensary light centers with greater economy and not less beneficial results.* Of the 110 cases concluding treatment in 1927 on attaining quiescence of disease, the consultant tuberculosis officers would normally have recommended 44 for treatment at special or general hospitals, and 28 for out-patient treatment at a skin hospital. Based on the average duration of treatment of such cases the cost of their treatment would have been *not less than* £1,436, whereas their treatment at the dispensary light centers actually cost (all inclusive) £525, *a saving of* £911. A *corresponding saving may be expected* with every confidence from the other light centers which are being established."

The official reports of medical officers of health in many different parts of the country bear striking testimony to the good results achieved by light treatment, and these have undoubtedly had an effect in further extending the treatment.

The subject has been studied with considerable care by the Scottish Board of Health, and it is interesting to note the observations made in the 8th Annual Report of that body (1926), and subsequently reprinted as a separate booklet under the title of "Ultraviolet Ray Therapy" for the guidance of all practitioners anxious to have an authoritative official statement on the matter. It will be noted that this booklet is part of an official report, and therefore cannot be taken to err on the side of unfounded optimism.

In its introduction, the report sums up the position in the words

"The clinical results have been sufficiently numerous and striking to justify the conclusion that this particular form of treatment has come to stay. Its value is becoming more widely appreciated, and the sphere of its usefulness better defined."

OPINION IN SCOTLAND

It then goes on to the discussion of various points, basing its remarks on evidence supplied from clinicians throughout the country. In a section dealing with non-pulmonary tuberculosis

the report alludes to the differences of opinion and the difficulty of attributing successful results to any one factor in treatment. It proceeds:

"In Scotland as a whole opinion is clearly in favor of irradiation. In a large number of cases there is no doubt in the minds of the clinicians that ultraviolet irradiation has been the main factor in hastening recovery; cases that have dragged on for months or years without making progress have responded rapidly to treatment by irradiation. The results have, by some, been attributed in part to suggestion; this may be a factor, but it can hardly be the most important one. Moreover the universal testimony of light clinicians is that practically every patient irradiated experiences an improvement in his general condition, feels better, eats better, sleeps better, etc. Suggestion is seldom so universally successful."

On the subject of tuberculous glands, the report states:

"Irradiation by ultraviolet rays has been particularly successful in the treatment of lymphatic glands, especially those that are superficially situated. Where the glands have broken down and discharged, leaving a sinus, irradiation seldom fails to give good results. The sinus heals, and the scar left is usually a supple one, blending well with the surrounding skin. Many of these cases show very rapid improvements under the effects of the rays, but ultimate cure may nevertheless take many months."

Space does not permit lengthy extracts from the report, but, in view of the M.R.C. Report, one cannot refrain from abstracting the following, from the section on Child Welfare:

"Two years ago the Carnegie Child Welfare Center, Motherwell, was the only center in Scotland that treated child welfare cases by ultraviolet radiation. At the end of 1926 there were 14 child welfare centers equipped with ultraviolet lamps, and several others had the installation of lamps under consideration."

MARKED GENERAL IMPROVEMENT

Then follows, with regard to the Glasgow Public Health Department Light Clinic, these observations:

"Normally, nervous stability is increased and a greater sense of well-being is evidenced in a more friendly and sociable attitude of the child to its environment. Sleep, appetite, color, activity and muscular tone all improve; the skin improves in texture, the height and weight increase, especially when markedly below normal. In *rachitic cases*, in addition to these signs of general improvement, x-ray examinations repeated during treatment showed marked improvement in the bones, especially when the cases attended regularly. Rachitic deformity was decidedly lessened by radiation, epiphyses diminished in size, wide fontanelles closed, tibial and abnormal spinal curves tended to straighten, and waddling gait almost disappeared.

Examination of *blood changes* was made in the bacteriological laboratory. A constant change was noted in the rise of the haemoglobin content, and there was also an increase in the number of red cells and leukocytes. In one well-marked case of anaemia the haemoglobin rose from 25 to 75 per cent during treatment extending over a period of a year, each course lasting about two months with six-weekly or two-monthly intervals."

Summing up the question of light treatment in Child Welfare work, the report concludes:

"On the whole the results are most encouraging. They fully justify the expense and labor involved in providing this method of treatment, and it is gratifying that the encouragement given to local authorities to provide ultraviolet treatment at child welfare centers has resulted in the effective restoration to health of large numbers of children."

With this summary of the history of light therapy, and these few indications (out of a mass of available material) of the extent to which it is proving of value every day in this country, we pass to a consideration of some of the specific points raised by the Medical Research Council's Report.

COST OF LIGHT TREATMENT

Consider, first, its allusion to the cost of light treatment.

On page 13, it is stated, "it commonly costs three or four shillings to give by light an effective supply of vitamin D, that would cost less than a penny if given by mouth in the form of cod-liver oil or otherwise." It would be interesting to know how these figures are arrived at. In the first place, what is an effective dose? We may presume it is one that, repeated sufficiently often, would cure an ordinary case of rickets. Assume that a course to effect this lasts, at the outside, 60 days (2 months). At ½ oz. of cod-liver oil per diem, this would mean 30 ozs. or

1½ pints. Now 3/-per pint is a common price, so the cost of curing a child with this would be be at least 4/6, and this does not include the fee of the doctor prescribing it. Assuming further that you could cure this child in 2 months by a mercury-vapor lamp in a clinic belonging to a public authority, it would require 16 treatments for the same period, at two a week. This in electric current would cost 1/2 for the lot, or just under one penny per treatment. If you include overhead charges, drugs and appliances accompanying repairs to buildings, lamps and equipment, salaries of medical officers, attendants, etc., the cost per treatment works out at 8d.—a not extravagant sum considering that the children receive this treatment in the open air when weather permits and that it is accompanied by exercises here as well.

These figures have been taken from a report supplied to a public body which gives light treatment for the poorer inhabitants, and they are extremely difficult, if not impossible, to reconcile with those given in the M.R.C. Report, which are so fantastic that one cannot imagine their basis.

It will, of course, be obvious that the foregoing figures regarding cost of treatment cannot be taken as a basis for calculating costs of such treatment by specialists or general practitioners; treatment by these involves individual irradiation and attention, as opposed to the "group" method followed by public bodies. There are also other factors which render comparison fallacious.

VALUE OF "DIRECT" TREATMENT

There are two further points about codliver oil and diet as a possible substitute for ultraviolet irradiation. One of the great merits about light treatment in an out-patient department, a tuberculosis dispensary, or similar place, is that the patient can do nothing to negative the effect after treatment. It is directly administered, and cannot be rubbed off, like an ointment, nor thrown away, like medicine. When codliver oil is prescribed, what guarantee is there that it is taken as ordered? What about the patient who can't or won't take it? There are many who cannot or will not take it owing to strong dislike of its taste, just as there are very many children and adults who could not benefit from it even if they conquered their distaste, owing to inability to digest fats. The same difficulty with digestion applies to whatever special diet might be prescribed, in certain cases, and thus the skin frequently becomes the only practical medium for absorbing this class of nourishment.

Again, so far as codliver oil is concerned, is it always certain that the oil is really active? At the 1st International Conference on Light and Heat, Professor Huldschinsky explained that one of the difficulties he experienced in Germany was that so many codliver oils were totally inert. He had witnessed refining procedures and found that, in a considerable proportion of cases, every fraction of the vital principle was extracted by refinement. It is at least possible that some of the codliver oil preparations marketed in Britain are no less inert.

Codliver oil and various other dietary preparations have their place in light treatment, and act as useful adjuvants. But there is no evidence that they form a practical and efficient substitute.

LIGHT AND RICKETS

In any case, is it true that codliver oil, without adequate sunlight, is a true preventive of rickets? In this connection reference should be made to the findings of the German Scientific Expedition to Iceland (1926-27), reported on by Dannmeyer in the *Umschau* of September, 1928, and discussed in this Journal recently.*

In this expedition it was found that rickets is rare in Iceland, where they have a diet containing plenty of fishy anti-rachitic oils and good sunlight; whereas in the Faroe Islands, where they have the same diet, but little sunshine on account of dense fogs, rickets is very prevalent.

Further, codliver oil has been prescribed by the medical profession over many decades, but has not banished rickets. It is obvious, therefore, that codliver oil alone is not enough, and Huldschinsky's discovery in 1919 of the curabil-

*Solar Radiation, Vitamin D and the Prevention of Rickets.—B. J. Act. & Phys., 111, 9, p. 175 (Dec., 1928).

ity of rickets by artificial light has not yet been superseded.

EFFECTS OF ULTRAVIOLET IRRADIATION

As to the statement that the only other medical use of "light" radiations which have a basis in physiology depend upon their power of exciting a local inflammatory reaction on the skin, this only shows that the writer of the report is not acquainted with the literature of the subject. With reference to ultraviolet irradiation in athletic training, Backmund has found that the production of an erythema raised the capabilities of athletes, but that irradiating the body for a long time with weak radiation, but *without* the production of an erythema, also leads to favorable results to the whole organism, which persist a long time. In other words, benefit can be received without the production of an erythema.

Irrefutable cases can be quoted where an attack of lumbago has been *cured* within five minutes of the conclusion of a treatment by a mercury-vapor lamp, and at least *four* hours before the erythema appeared. The lamp being a mercury-vapor one, at a distance of 24-30 inches. Erythema will not explain such results, unless the muscles and fibrous tissues intelligently anticipated the erythema which actually occurred later.

One particularly strange phrase appears in the report, when discussing the increased bactericidal power of the blood which is one of the sequelae of the local inflammatory action of light. It is stated that "there is at present no reason to know that artificial light can do no more in this way than a mustard plaster." Is this an attempt to gain a laugh by a cheap witticism, or is it seriously suggested that the use of artificial light should be abandoned in favor of mustard plasters? This would be such a staggering proposal that it seems there must be some other reading of the report. For surely the council realizes that it would be impossible to subject a patient to mustard plaster treatment for an area of any great size, that the treatment is painful and cannot be borne by many patients, and that it is out of the question in the case of very young children. To refer to a recent case which has been very much in all our minds, it would have been nothing less than madness to apply a mustard plaster to a patient suffering from a serious toxic illness whose power of resistance it was desired to assist *with the minimum disturbance*. It is, of course, impossible to apply a mustard plaster where there is a rash, a discharging sinus, or any kind of broken skin.

A reference is made to experiments on the monkeys kept at the Lister Institute and the National Institute. Both monkeys thrived equally, the one on a daily dose of codliver oil, and the other on a daily dose of ultraviolet light. This experiment proves nothing unless the codliver oil monkeys were kept strictly in the dark. Light of any kind has powerful biologic effects, and we do not know to what extent the combination of light and codliver oil affected the result. It is quite an unwarranted assumption that codliver oil can replace light.

EFFICACY OF LIGHT ALONE

Many very good observers would have it that the actual sunlight used in heliotherapy is not by any means the single or the principal factor in the indisputably successful results achieved, and that "artificial sunlight" must therefore be only of very slight avail. They attribute a very large or even predominant share of the good results at such places as Leysin to the pure air and other concomitants. But abundant evidence on the other side can be obtained from Copenhagen, where open air plays an insignificant part—or no part at all—in the cure of tuberculosis. In this connection we may refer to a case which came under the notice of one of the present writers:

E. H. (female), aged about 18, was taken for treatment in August, 1924. She suffered from tubercular disease of the hip and shoulder, and had been completely bedridden for four years, with numerous discharging sinuses. She had had numerous surgical operations on the hip and shoulder with no result.

She was brought up for treatment in a spinal carriage, and was treated by a carbon arc without being taken out of the chair. In three months

she could sit up, and in five months her menstrual period returned after a prolonged absence.

In 1925 a bony sequestrum was extruded spontaneously from the shoulder, and about this time the carbon arc was replaced by a mercury vapor lamp. Treatment was continued with this and in 1927 all the sinuses were healed up, so that at the present time she is walking about quite comfortably with a patten on the short leg.

It is important to note that in this case there was no treatment except by a carbon arc first and a mercury-vapor later. Home conditions all through were controlled, and remained unaltered. No special medicines were given. This case, therefore, is a standing witness to the efficacy of light alone, and there is no doubt that hundreds of similar cases could be cited.

The Medical Research Council's jibe at faith healing and suggestion can be answered in many ways. If healing is accomplished, does it matter whether it is done through the mind or the body? Here again the poverty of clinical experience is evident. Of recent years the medical profession has come to realize the importance of mind in treatment, and a whole paper might be written on this change of medical opinion. One of the most remarkable effects of sunlight and ultraviolet light, as attested by many competent observers, is that the patients become much more cheerful, showing how the light produces profound and unexplained effects on the human mind and body. This is an every day experience, but it has only recently been taken cognizance of by the medical profession. To decry it savours of a mental attitude which is alien to modern scientific opinion.

The foregoing comments will, it is hoped, demonstrate the rash and inconsiderate nature of many remarks and innuendos in the section of the M.R.C. Report devoted to artificial light therapy. Further comment will be reserved until the details of Dr. Colebrooke's Willesden experiment are available, for the value of any conclusions which may have been drawn from it depend entirely on the correctness or otherwise of the scientific methods used in carrying it out.

(Representative views will follow in next issue.)

DR. PARISEAU'S WORK

Dr. Leo E. Pariseau has recently completed a series of experiments dealing with the passage of high frequency currents through the tissues. This was reported in the Canadian Medical Association Journal, 1929, XX, 146-152, under the heading of "Diathermy: A Critique and An Experimental Study."

The first public demonstration was given at the University of Montreal, November 15, 1928, and the first publication was reported in L'Union Medicale, December, 1928.

Dr. Pariseau brought to this experimental work a keenly analytical mind and a wide knowledge of all forms of physical therapy. Although this work was done in the laboratory it is our impression that it has very great value as to the indication of the method of passage of high frequency currents through the tissues of the human body.

For his experiments he used tetraiodomercuriate of silver

> "mixed with the agar at the very beginning in order to approximate as much as possible a photographic emulsion. When cool the mass resembles custard. If beating is continued until the temperature has fallen below the setting-point of the agar, a thick cream resembling mayonnaise is obtained. The cream is much more convenient to use than the jelly but, of course, the jelly is indispensable where depth effects are to be studied. Both products are easily prepared, cost about a dollar a quart, and can be used over and over again."

This substance is canary yellow when cold and orange red when hot, so that by applying the high frequency currents to this substance changes in color, which can be seen by the naked eye or enhanced by use of color filters, can be produced. Not only can these color changes be seen but can also be permanently recorded on orthochromatic photographic films. The only electrodes which can be satisfactorily used with this substance are those of "Monell metal" because of the fact that other metals undergo chemical change when in contact with the mercury-silver-agar emulsion.

These experiments prove visually that when high frequency currents are passed through the mercury-silver-agar preparation, the heat begins near the electrodes at their edges and slowly spreads across between the two electrodes assuming the shape of an hour glass. On the other hand, where the jelly-like substance is cut to the shape of an hour glass before the current is applied, the earliest and greatest heat occurs at the narrowest portion of the jelly. This is in accord with the well known fact that the same amount of current passed through a mass of small diameter causes more heat than when passed through a mass of greater diameter. (Compare the base of the hour glass with the constructed central portion.)

To show the effect of heat produced by interposing bodies of different conductivity from the agar jelly, the author placed bodies of good conductivity and bodies of poor conductivity between the electrodes. When bodies which are good conductors were placed in the mercury-silver-agar jelly symmetrically between the electrodes, the point of greatest heat was shown to be on opposite sides of the conductor body. When placed assymetrically in the agar the current swerved to the conductor, the greatest point of heat varying with the relative position of the conductor and the electrodes.

On the contrary, where nonconductor bodies were placed between the electrodes in the agar jelly, six hot spots first appeared, one at each edge of each electrode and one at each lateral aspect of the foreign body. As the current was continued, the six spots fused into two lines extending between the two edges of the two electrodes.

The author draws the following conclusions:

"1. 'Diathermy' is not a misnomer. Currents of the frequency used in medical practice do not flow over the surface of colloid-saline masses; they go right through, and they are capable of heating all through.

"2. The path followed by such high frequency currents is very similar to that which would be followed by unidirectional or low-frequency currents.

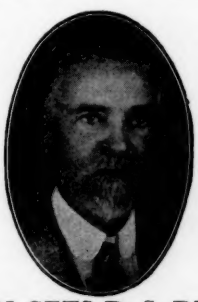
"3. 'Skin effect' need not be a bugbear or a deterrent. Experiments made with hollowed-out bologna sausages or cylinders of salt solution may tend to show that skin-effect is quite noticeable during diathermy, but such experiments are fallacious because they are based on meter readings and because the test object is altered in the course of the experiment. When the test-object is left untouched and the doings of the current judged by the appearance and distribution of heat, skin effect seems a negligible factor.

"4. Superficial hot-spots and 'edge-effects' are manifestations of an uneven electrical field rather than of poor contact or sharp edges. More attention should be paid to the relative size and position of the plates in each particular instance.

"5. 'Maximum heat at the centre' is a misleading slogan. In a homogeneous, unobstructed and unconstricted electrical field the greatest heating effect is always to be found near the electrodes and not halfway between them.

"6. Internal hot-spots or islands are, however, theoretically possible in certain cases, for instance, when a bone or an intestinal loop filled with gas occupies a relatively large portion of the diathermic field.

"7. The blood stream tends to nullify the deeper local effects of diathermic currents but the interaction of both superficial and deep circulation with the heat regulating centres of the body could easily reverse the heat gradient observed in some of our experiments. When and within what time this occurs is a question that cannot be solved by 'in-vitro' investigators."—A. F. T.



JERMAN GETS D. S. DEGREE

A current news item informs us that the degree of Doctor of Science was recently conferred upon Mr. Ed. C. Jerman, by Franklin college of Franklin, Indiana.

This information will be of interest to Mr. Jerman's many friends in the X-ray field, both

here and abroad, who are familiar with his contributions toward the standardization of operative X-ray technic. His technical articles in the specialty journals have created considerable interest for some years past, and his book, "Modern X-Ray Technic" which appeared last fall, has received many favorable comments and reviews.

Mr. Jerman's experience in this field dates from 1895, when cable messages informed America of Prof. Roentgen's great discovery. At that time he was engaged in the manufacture of static machines and other electrical devices for therapeutic purposes, and became intensely interested in reading the newspaper reports and the scientific journals pertaining to this discovery. Everything was available with which to try the experiment, except a Crookes tube, but this was obtained as soon as it was possible to make the importation. It was on the night of March 16, 1896, that Mr. Jerman and three of his associates made their first experiments, which were concluded at 3 o'clock the next morning. They succeeded in obtaining a radiograph of the hand in a 30-minute exposure, sufficient to show the shadows of the bones of the fingers.

Mr. Jerman has lived each chapter since written into the history of the development of the X-ray art. His interest has been largely on the technical side of the equipment used in the X-ray laboratory, in studying out the most practical methods for its application in view of obtaining better and more uniform results in radiographs, from the standpoint of diagnostic quality. Members of the medical profession in practically every country in the world have benefited by his instruction work in this field during the many years he has been so active in it. Thousands attest to his ability to impart to others a knowledge of the fundamentals of operative X-ray technic, in such a way that an improved quality of work becomes possible immediately, and the various problems that enter into the daily routine become simplified, through logical deductions based upon these fundamentals.

It is in recognition of "outstanding achievements in his chosen field" that the degree of Doctor of Science is conferred upon Mr. Jerman by his alma mater.

THE CLEVELAND CLINIC DISASTER

(Reprinted from the Ohio State Medical Journal for June, 1929)

To the medical profession of Ohio, especially, is the catastrophe at the Cleveland Clinic on May 15 a saddening shock.

As phrased by one commentary—every element of tragic drama was magnified, every well-spring of human emotion exhausted. In the inscrutable weaving by the weird Sisters were fashioned there the destruction of a great humanitarian enterprise—of an institution dedicated to the work of cheating death and healing broken bodies. Truly a tragic and ironic fate.

Such a cataclysm occurrence was unthinkable—a combination of elements and events which in all probability can never occur again. The medical profession sympathizes deeply with the families of the victims; and with those whose vision and purpose it was to create and maintain the Cleveland Clinic as an institution of mercy and of the highest scientific service. It mourns the loss of some of its ablest, and most promising members, whose further service to humanity is abrutly ended, and its heart and hand go out to those whose faith and duty it is to carry on, to recreate and to continue in accord with medicine's noble traditions.

As stated by one newspaper editorially: "Doctors, nurses and experts in various lines of healing laid down their lives, true to the last to their duty to suffering humanity."

As always in great emergencies, human nature rose grandly to the dreadful occasion. In this must be the solace.

THE STUDENT'S LIBRARY

BOOKS RECEIVED

This column is devoted to acknowledgment of the books received. Such acknowledgment must be regarded by the sender as sufficient recognition of the courtesy until time and space permit selections to be made for review.

DIE GASTROSKOPIE IM RAHMEN DER KLINISCHEN MAGENDIAGNOSTIK. *Dr. Kurt Gutzeit,* Univ. at Breslau. (Gutzeit, Gastroskopie in Relation to Clinical Gastric Diagnosis.) Illustrated, 98 pp. $2.00, paper bound. Berlin, Von Julius Springer, Publishers.

PHYSICAL THERAPEUTIC TECHNIC. By *Frank Butler Granger,* A. B. M. D. Late Physician-in-Chief, Dept. of Physical Therapeutics, Boston City Hospital; Director of Physiotherapy, U. S. Army; Medical Counselor, U. S. Veterans Bureau; Member of Council on Physical Therapy, A. M. A.; Instructor of Physical Therapeutics, Harvard Medical School, etc., with a foreword by *William D. McFee,* M. D., Boston, Mass. Octavo volume of 417 pages with 135 illustrations. Philadelphia and London: W. B. Saunders Company, 1929. Cloth $6.50 net. W. B. Saunders Company, Philadelphia, Penna.

BOOKS REVIEWED

PHYSICS FOR MEDICAL STUDENTS. By *Sidney Russ,* D. Sc. (London), F. Inst. P. Joel Professor of Physics, The Middlesex Hospital Medical School, Physicist to the Middlesex Hospital, Fellow of University College, London, Fellow of the Royal Society of Medicine. E. and S. Livingstone, 1928, Edinburgh.

As stated in the preface the scope of this book covers all that is generally expected of a student taking the pre-medical examination in England. Physics has become an important science for the medical student. With the advances constantly being made in electrotherapy an understanding of its fundamentals is of paramount interest.

The contents include chapters on mechanics, heat, light, sound electrostatics, magnetism, x-rays and radiosensitivity. The subject matter is presented in a simple manner and if supplemented by laboratory experiments should enable the beginner of medical study to grasp the principles so necessary in scientific endeavor. Aside from the theoretical considerations the practical examples are of value. They help the student to see the real reasons for a study of the theory first.

Our understanding of heat would be aided by reading the chapter on this subject. The author tells us that heat is a mode of motion, and that a difference exists between temperature and heat. Many have not considered these phases in this way, yet they are facts based upon physical evidence.

The chapter on light is of special interest. Thus we learn that light is a disturbance in the ether, and of such a kind that it causes the sensation of vision. Later in the discussion the optical principles are considered and with these defects in vision. The practical application is always presented.

In general this little volume is not only of value to the medical student, but also a handy and instructive reference for the physician who would benefit by a review of the fundamentals of light, heat and electricity.

—A. R. H.

ARTHRITIS AND RHEUMATOID CONDITIONS, THEIR NATURE AND TREATMENT. By *Ralph Pemberton,* M. S., M. D. Physician to the Presbyterian Hospital, Philadelphia; Associate Professor of Medicine in the Graduate Medical School of the University of Pennsylvania, etc. Illustrated with 42 engravings and one colored plate; 354 pp. $5.00, Lea and Febiger, Philadelphia, Publishers, 1929.

This is a book which every physician using physical therapy in arthritis should read. The influence and use of heat, form the indications for use of massage, exercise, postural exercise, rest, diathermy, ultraviolet, light and the faradic current, are thoroughly considered. The role of the intestine and the indications for and the technic of colonic irrigation in the treatment of arthritis are also made clear in this volume. There is a section on the influence of diet and the types of diet to be employed in this disease. The author has made a point to avoid undue emphasis upon any one phase of treatment, for he believes that only wide angled vision can attain to anything more than sporadic results in any large group of cases.

—John S. Coulter, M. D.

THE VERTEBRAE. ANNALS OF ROENTGENOLOGY, VOL. EIGHT ROENTGENOLOGICALLY CONSIDERED, INCLUDING A STUDY OF INDUSTRIAL ACCIDENT CASES. By *Arial Wellington George,* M. D., Sc. D., F. A. C. R., and *Ralph Devis Leonard,* A. B., M. D. Edited by James T. Case, M. D. Two hundred and three Roentgen ray studies, thirteen clinical illustrations and one colored plate. 256 pp. $10.00. Paul B. Hoeber, Inc., New York, Publishers, 1929.

This excellent monograph, splendidly illustrated, is offered to the medical profession especially those interested in industrial and traumatic surgery with the hope that it will aid to a better understanding of some of the common conditions of the vertebral column.

It is divided into two parts. The first part is a general introduction considering the standardization of interpretation, structural abnormalities of the spine, and the pathological conditions in the vertebrae. These pathological conditions are considered under the classes, diseases which destroy bone as tuberculosis, malignant new growths, destructive benign tumors and osteomyelitis; diseases which produce bone, as arthritis, syphilis, benign bone tumors; and diseases of uncertain etiology as rachitis. These are well illustrated.

The second section is a sectional and detailed study of the vertebral column. That difficult region the lumbar spine is thoroughly considered with many splendid illustrations.

There is an appendix on medicolegal expert testimony which considers the essential features to be observed in giving expert testimony.

—John S. Coulter, M. D.

INTERNATIONAL ABSTRACTS

Roentgentherapy of Trachoma. Drs. N. S. Lipowitz and G. G. Salzmann (Smolensk) Dtschr. a. d. g. d. Roentgenstrahlen. Vol. III, No. 2, 1928.

The authors (the former an oculist, the latter a roentgenologist) have worked for some time in the Smolensk state university eye clinic (Russia) with the x-rays as a therapeutic agent in trachoma. They point out that the first attempt to cure trachoma with light rays dates since 1903, and that after a long interval the treatment is again arousing general interest. A number of discussions at the first Ophthalmologic Congress and contributions to the literature indicate the efficacy of the x-rays in this affection.

One and a half years ago the authors endeavored to evert the eyelids and apply the x-rays direct to the mucous membrane, the eye ball being protected by lead. The need to fix the conjunctiva with catch forceps proved, however, a deterrent, as the patients suffered. Cocainization was not risked for obvious reasons. They then decided to apply the rays through the eyelids while the patients were in a recumbent position. Two, rarely three treatments were administered after intervals of two to three weeks. The total treated were 32 with trachoma in the first stage and 6 in the second stage. To this must be added cases complicated by pannus and four men with papillary trachoma a grand total of 44. All were adults.

The greatest care was taken to make exact diagnosis and to test the vision before and after the seances. There was never any impairment of vision from the treatment. To maintain scientific control, they treated the worst of the two eyes in patients, and left the other to be managed routinely. The patients felt so much improved in the radiated eye that they asked to have the other one treated. In the cases with pannus, photophobia and tearing disappeared, the pannus cleared up and the hypertrophy of the conjunctiva diminished to a considerable extent.

Objectively there was a slight reaction on the eighth day. In the interval applications of sol. hydro. cyan. (1:6000) and xeroform ointment (5 per cent) were applied.

The apparatus used and technic employed are described in detail.

The authors come to the conclusion that the x-rays have a direct influence on the affection. Cures are obtained in a short time without recurrences. They consider the treatment humane, painless and harmless.

The x-rays do not influence the virus, but by curing the pathology removes the site for its development. Irrigation and ointment treatment must be applied in the intervals.

Physical Therapy in Dermatology. E. William Abrahowitz, M. D., Clin. Med. and Surgery, Vol. 36, No. 4, April, 1929.

Physical therapeutic measures have established themselves as extremely useful agents for the relief and cure of skin diseases. The agencies employed are the various forms of radiotherapy, such as radium, roentgen ray, "grenz" ray, ultraviolet and infra-red therapy; the different types of galvanotherapy, such as the simple galvanic current, electrolysis, ionic medication

and bipolar methods of surgical diathermy; and refrigeration.

Adequate technical knowledge of each agency, its limitations and advantages, and a thorough understanding of the nature of the skin lesion being treated, are essential for the intelligent treatment of dermatoses by these means.

Progress in physical therapy is due to the mechanical era in which we are living. It does not entirely supplant the medicinal measures still in use in dermatology, but it is an important addition to our armamentarium in combatting the various affections that the skin is heir to.

Medical and physical means are not the final aim of therapy if they only relieve the local symptoms. The ultimate goal of skin therapy is to correct or eliminate the various instigators of cutaneous eruptions, thus not only curing the skin lesion but the patient as well. Much progress is being made in this direction, but where such remedial systemic measures are lacking, we must employ those local agents that have proven to be most efficient. Physical therapy fulfills this need in many instances.

X-Ray Diagnosis of Aneurysm of the Abdominal Aorta Pneumoperitoneum. M. Memenow. Vestrik Roentgenologie 26:1928.

Aneurysms of the abdominal aorta, in the opinion of the author are rare. The clinical methods of examinations are, as a rule, insufficient for the establishment of a diagnosis. As regards x-ray examination by ordinary transillumination the result is also unsatisfactory, as the shadow of the dilated aorta does not show sufficient contrast. The situation is, of course, different if the aneurysmal walls happen to contain calcerous deposits or when the pulsating shadow of the aorta is separated from the stomach. Under such conditions aneurysm may be diagnosed with a good deal of probability. In a few cases the diagnosis can be successfully arrived at through the inflation of the intestine with air.

In view of the diagnostic limitations of the x-rays in this type of disease, the author has tried out in four reported cases the *production* of pneumoperitoneum.

The author does not consider this procedure dangerous as the increased pressure in the abdominal cavity is so little that it is entirely likely to have any influence worth considering on the wall of the aneurysm, as indeed the procedure was carried out in the author's four cases without an undue incident. The radiograph thus obtained facilitates the diagnosis (situation of the shadow as a rule to the left of the median line, sharp contours, plain pulsation.) In very large aneurysms in which pulsation is absent the differential diagnosis is rendered very difficult. In one case the author even succeeded in diagnosing a diffuse dilatation of the aorta which was not at all pronounced in size. The correctness of the diagnosis was confirmed partly through the clinical course of the affection, partly through the post mortem finding.

The author stresses the importance of examining the vertebral column as this may show erosions from pressure by the aneurysm.

(Aneurysms of the aorta are not as rare as the author seems to believe, at least not in the United States.)

Influence of Roentgentherapy in the Blood Calcium in Basedow's Disease and Bronchial Asthma. L. Protas. Vestnik Roentgenologie, Vol. 6, 1928.

The author studied a material of 44 patients suffering from Basedow's disease and of 37 patients afflicted with bronchial asthma. In the first group repeated observations was the rule. In 71 per cent of the patients with Basedow's disease the blood calcium content was increased before radiation, 18 per cent showed normal blood calcium while 11 per cent had a finding of subnormal content. The last two groups represented clinically mild cases. Thirty-eight patients were examined after they had been treated with x-rays. In 28 cases the blood calcium content was lessened so that it approached normal limits and all these cases showed also good results with regard to their general well being. In seven cases the calcium content increased after radiation while in three cases it remained unchanged, and this in spite of the improvement in some symptoms and the general condition. The cases which showed a subnormal content before radiation were found to have a normal amount of blood calcium after treatment. The changes in the blood calcium content which appeared after radiation remained for a long time, during which observation was carried on.

The patients with bronchial asthma presented the following data. In 22 of the 37 (60 per cent) the blood calcium content was normal, in 12 cases (34.5) it was increased while in 2 cases (5.5 per cent) it was diminished. A relation between the blood calcium content and the gravity of the disease could not be established. Thirty-one patients were examined after treatment with the x-rays. In most of the cases which had an abnormal blood calcium content, normal relation was secured. There was, however, no parallelism between the change in the calcium content and the effect of the x-rays on the morbid phenomena, as it was also established that the variations in the blood calcium content are not dependent on the site to which radiation has been applied.

The Indications for Radiation Therapy in Benign Uterine Hemorrhages. Henry Schmitz, M. D. Ill. M. J., Vol. LV, No. 3, March, 1929.

The number of patients with uterine hemorrhages was 802 or 37.70 per cent, in 2117 cases admitted to the gynecologic service of the hospital.

The uterine hemorrhages were divided into three groups:

Hypermenorrhea, or profuse and prolonged menses, numbered 335 cases, or 41.98 per cent.; polymenorrhea,

or too frequent menses, numbered 97 cases, or 11.66 per cent; and metrorrhagia, or uterine hemorrhage occurring without the menstrual period numbered 370 cases, or 46.36 per cent, which number includes 253 cases or 31.70 per cent of cancers.

The underlying causes and diseases have been discussed and grouped with the respective numbers and percentages. Those groups indicating medical or surgical treatment or containing the cancers have been deducted as the purpose of the study is "the indication for radiation therapy in benign uterine hemorrhages." The number thus remaining was 225 cases.

The methods of treatment employed in each group has been given in numbers and percentages and the indications for radiation treatment discussed.

Medical treatment was curative in 59 cases, or 26.22 per cent;

Surgical treatment (that is dilation and curettings) was curative in 105 cases, or 46.67 per cent; and

Radiations were indicated in 61 cases, or 27.11 per cent.

Finally emphasis has been given to the necessity of a correct diagnosis before treatment is begun. With a doubtful diagnosis immediate diabnostic curettage or excision of suspicious areas of tissues and microscopic examination must be performed to rule out or rule in malginancy.

Five Year End Results of Cancer of the Vagina, Vulva, Clitoris and Labia Treated by Irradiation. Bernard F. Schreiner, M. D. The Radiological Review and the Chicago Medical Recorder, Vol. 51, No. 5, May, 1929.

Only one of the nineteen cases of epithelioma of the vagina has remained alive and free from disease for over six years.

Fistulae occurred in three cases, due to the extension of the disease and to the radiation treatment given.

Two cases of epithelioma of the vulva were alive and free from the disease for periods of over six years.

The use of glass seeds in the treatment of these lesions is inadequate, and causes great suffering and should be abandoned.

Electrocoagulation and gold seeds offers a better possibility in the relief of the suffering, as well as in a curative way. This statement is based on the treatment of my cases since 1924.

It would appear that the treatment of cancer of the vulva, clitoris and labia, should be radical, in the beginning, by means of coagulation and radition.

Ultraviolet Rays. Morris Fishbein, M. D., Editor of the Journal of the American Medical Association and of Hygeia. Scientific American, June, 1929.

Among recent investigations of the use of ultraviolet rays is a series of studies made in the Children's Hospital of Western Reserve University School of Medicine. An attempt was made to find the approximate minimal dose of ultraviolet rays as produced by the quartz lamp, which, with exposures given once weekly, would cure rickets. White and colored children were given exposures to the quartz lamp and the extent of the rays was measured by the response of the skin.

Regular pictures were taken with the x-ray machine to find out how much the bones were reacting to the dosage. All of these infants were receiving diets of orange juice, milk, skim milk, and lactic acid, with enough sugar to meet the requirement for energy according to age. It was found that exposure of the infant by placing it, while naked, on the stomach or back for one period each week would cure rickets.

The quartz lamp was placed at a distance of 32 inches for ten minutes, that being a sufficient dosage. In white children with tender skins there is decided redness following such exposure, but not inflammation to the point of peeling of the skin. In case the reaction of the skin is too severe, the dose may be reduced to one half the amount mentioned.

The Diagnosis and Treatment of Uterine Cancer. Henry Schmitz, M. D. The Radiological Review, Vol. 51, No. 5, May, 1929.

The frequency and preponderance of carcinomas of the female reproductive organs has been demonstrated by statistics.

The observation has been discussed that the first stages of carcinoma of the uterine cervix do not cause symptoms and that nodules and ulcers are more often benign than malginant. When a cervical cancer causes symptoms then it probably has already progressed to an advanced stage. Hence the microscope must be used to diagnose malignant nodules and ulcers from similar benign conditions.

The pelvic examination of all recent mothers and the inclusion of pelvic examinations in periodic health examinations are the only means of detecting chronic inflammations of the cervix which should probably be treated whether they cause or do not cause symptoms. Chronic cervicitis is probably the period of advent of cervical carcinoma.

The influence of the extent of the growth on the prognosis has been shown by statistics on five-year good end-results. The indications for the various methods of treatment are based on the clinical grouping. The contra-indications for surgery have been given. The factors employed in radiation treatment have been briefly mentioned. The palliative treatment of the incurable stages has been described.

Cod-Liver Oil and Activated Ergosterol Therapy. Its Present Status. Norman Ward Clein, M. D. Northwest Medicine, Vol. XXVIII, No. 5, May, 1929.

Several specific substances are available for the treatment of rickets and other conditions involving calcium deficiency. Cod-liver oil varies in potency to a

marked degree. Cod liver oil of known stated potency should be prescribed when its use is desired, in the same manner as any other standard drug.

Ultraviolet light can be used as a definite cure for rickets, by stimulating a more rapid absorption of calcium.

Activated ergosterol apparently is the most simple means available for the prophylactic and therapeutic dietry treatment of diseases of calcium deficiency.

The Effects of X-Ray and Radium Upon the Fetus in Utero. P. W. Toombs, Am. J. Obstet. and Gynec., 17: 517-523, Apr., 1929.

Diagnostic exposure is not harmful unless resorted to too frequently. Therapeutic exposure causes abortion in the early months and various deformities of eyes, brain and cord during the later months. The severity of dosage and the period of fetal development determine the particular reaction of the individual fetus tissues, the younger the embryo the greater the injury.

Malignancy superimposed upon pregnancy demands measures sufficient to destroy cancer, the life of the fetus, of course, being disregarded.

In obscure cases, pregnancy and fibroids coexisting, and in elderly women, the probability of pregnancy should always be kept in mind in order to avoid subjecting the supposedly absent fetus to immediate death or something worse.

The Treatment of Arthritis, Rheumatism and Neuritis with Chemotherapy and Physiotherapy. W. M. Bartlett and E. Suneson, New England J. Med., 200: 375-376, Feb., 1929.

In dealing with infectious arthritis, rheumatism and neuritis, the first important duty of the physican is to find and eradicate infectious foci.

Active motion of joints, in spite of pain and muscle spasm, should be insisted upon. Vigorous and deep muscle massage is the most beneficial form of physiotherapy and must be applied daily. The salts of orthobenzoic acid do not cure arthritis. The ammonium salt, when given in large enough doses intravenously, can be depended upon to relieve pain and muscle spasm in the majority of cases and gives thereby opportunity for securing marked improvement.

Radium in the Treatment of Menorrhagia of Adolescence and of the Menopause. L. J. Stacy and R. D. Mussey, Am. J. Obstet. and Gynec., 17: 502-508, Apr., 1929.

In the adolescent period radium should not be used until after all general and other accepted measures of treatment have failed. The dose should be small enough to preclude any possible injury to the ovary. It is better to err on the safe side and repeat the dose several months later if necessary than to use a dose which might permanently injure the ovarian tissue. Although it is hard to establish a definite dosage, we believe that not more than 200 to 250 mg. hours should be used in the initial treatment.

It is evident that the use of radium is of distinct value in controlling menorrhagia of the menopause. From 800 to 1000 mg. hours of intrauterine radium in a single dose gives satisfactory results in more than 90 per cent of patients treated. The history of pelvic infection even eight or ten years previously or evidence of pelvic infection is a definite contra-indication to the use of radium. Preliminary curettage for diagnostic purposes should be carried out in practically all cases in which the patient is more than forty years of age.

Radium Treatment of the Toxic and Exopthalmic Goiter. O. W. Allison, Ill. Med. J., 55: 133-135, Febr., 1929.

The author explains the procedure in administering the radium and the dosage used. He gives the following reasons for choosing this method of treatment.

1. Usual freedom of danger.
2. Simplicity and ease of administration.
3. Usually no hospitalization.
4. No pain.
5. No anesthesia of any kind.
6. Generally good results with properly selected patients.

Kraurosis Vulvae. W. P. Graves and George Van S. Smith, J. A. M. A., 92:1244-1252, Apr., 1929.

An extensive review of the literature on kraurosis and leukoplakia indicates the difficulties arising from the conflicting terminology. A more uniform use of nomenclature is urged, and retention of the word kraurosis in its original sense being recommended. The clinical and histological evidence here presented shows that kraurosis and leukoplasia used in the classic sense are phases of an identical process.

Historical, clinical and histologic evidence further shows the intimate relationship of kraurosis and leukoplakia to cancer. The treatment of kraurosis is essentially surgical.

Pyrexia in Malignant Nephroma (Hypernephroma). C. D. Creevy, J. A. M. A., 92: 1256-1260, April 13, 1929.

Pyrexia is not an infrequent accompaniment of malignant nephroma (the so-called hypernephroma). It probably has its origin in the formation by the tumor of an abnormal product of neoplastic metabolism. The presence of fever may assist in, rather than obscure the diagnosis of malignant nephroma. Malignant nephroma should be considered whenever an obscure fever is present.

Birth Marks. John D. MacRae, M. D. Radiological Review, Vol. 51, No. 5, May, 1929.

Radium treatments of birth marks produce excellent cosmetic results when the lesions are superficial, and in cavernous angiomata they produce results which are better than by any other method.

Vascular nevi should be treated most conservatively and patiently. The treatment should be instituted as soon as the condition is recognized.

On Esstential Haemorrhages. The Cause and Treatment of the Essential Haemorrhages of Infants and of Other So-Called Functional Haemorrhages. A. Groves, M. D. Medical Review of Reviews, 34:477, October, 1928.

The author cites several cases of so-called functional hemorrhages in infants and in cases of bleeding following tonsilectomy in whom the bleeding was arrested following the application of a one-minute exposure to x-ray. No technic is given, but the author apparently assumes that this is known to the reader. He states that investigation has shown that x-raying the spleen stimulates in it the formation of a coagulating ferment, and if it does so it is proof that the production of this ferment is a normal function of the spleen, for a new function cannot be created in an organ by artificial means, but a natural function can be increased, or if dormant may be roused.

Radium Treatment of Cancer of the Bladder. A. C. Morson, M. D. British Lancet, No. 3, 1928.

In the presence of hemorrhages, infection and in all cases of cancer of the bladder, the application of radium through a cystoscopy is very restricted. The most essential thing in the treatment is the exact determination of the limits of the growth, and this can be attained only by suprapubic cystostomy. It is also of great importance for the treatment to determine whether one was to deal with the ulcerative or papillary type of cancer. Bi-manual palpation between the external and internal side of the bladder affords exact informtion about the situation of the tumor with reference to the ureter, rectum, iliac blood vessels and about the infiltration of the muscles of the bladder and of the cellular tissue of the pelvis.

The author unfortunately had available only platinum tubes of 10.25 and 50 mg. A change of dosage is fraught with great cost (about $350.00). In papillary cancer the tubes are inserted through the pedicle. secured by threads which are led through a small wound in the bladder wall and fastened to the skin. The tubes remain 24 hours while the drain of the bladders is left another 24 hours. In ulcerative cancers the tubes are inserted into the bladder wall at the margin of the ulcer (because there are the youngest cells) at appropriate distance and also into the cellular tissue around the ureter and iliac vessels.

The treatment for the present must be empiric as regards dosage, as not all patients react the same. Radium treatment with injection of heavy colloidal metals has not given good results because they are too toxic.

While the author has had to deal with advanced, inoperable cases, and cures with radium have not been attained, he has caused shrinking of the growth almost to the point of disappearance. Septic infection is to be almost regarded as a contra-indication to the treatment.

Radium is, however, very useful in hemorrhages, which can be controlled within 24 hours.

Radiation Treatment of Uterine Fibromyomata. A. Soiland, W. E. Costolow and O. N. Meland, Calif. and West. Med., 30:324-340, Apr., 1929.

Combined radium and deep x-ray therapy is the best type of radiation treatment in the majority of cases.

Radiation therapy is practically specific in controlling that type of hemorrhage which is due to uterine fibromyomata.

The majority of fibromyomata larger than a four months' pregnancy may be rendered symptomless by radiation.

Radiation is the treatment of choice in fibromyomata not larger than a four months' pregnancy.

Roentgenotherapy of Climacteric Phenomena. Dr. A. L. Kaplan (Moscow). Fortschritte Auf Dem Gebiete Der Roentgenstrahlen, No. 3, Vol. 38, September, 1928.

Kaplan presents in this article, which was partly read before the 4th Russian Roentgen congress, a really valuable contribution to the treatment of a very common and very annoying condition, which merits careful and thorough checking by every practitioner of medicine. It is well known that a large number of women become not only miserable but unable to live up to their usual occupations the moment their ovarial function has ceased. The violent congestions to the head, sweating, vasomotoric disturbances such as loss of equilibrium, restlessness, insomnia, sensations of fright, skin disturbances, even psychoses, all of which may persist for years, to say nothing of torturing headaches, elevation of blood pressure, pains of the muscles and joints, sensations of cold, etc., which drive both patients and physicians to despair, certainly are serious enough to cause us to try anything that holds out any hope of relief, especially when the proposed therapy has all the appearance of being arrived at on a scientific basis.

In many instances efforts have been made to supply the human economy with artificial ovarian substance in the hope that this will substitute for the missing endocrines, but as a matter of experience all such methods have been successful only in a few isolated, mild cases, but we all know how poor the results have been where they were most needed.

Basing on the later researches which show that there exists a distinct relation between the ovarian function and the hypophysis, Kaplan has resorted to radiation of the pituitary body in 25 patients. These, etiologically, were distributed as follows: 5 suffered from the natural climacterium, though some of these cases were of the precocious type, 12 had the climacterium produced artificially through roentgen treatments of uterine tumors, while 8 were due to surgical extirpation of the ovaries.

The author treated these women with a Coolidge tube, a tension of 180,000 volts with 4 ma. and utilized a filter of half a centimeter of zinc and one and one-half centimeter of aluminum, administering 1 to 2 radiations to the temporal region at weekly intervals. The size of field was 5 by 5 centimeters and a dose of 6 Holzknecht units was given per field.

The results have been striking, though he also reports a few failures—only three of the 25. In one there was decided improvement while in the remaining 21 cases there was complete cessation of all phenomena which did not return. It is necessary to state, however, that in one reported case there was a temporary exaggeration which, however, soon yielded, with excellent permanent results.

Radium Therapy of Cancer of the Urethra in a Woman. Dr. Fruchaud, Presse Medicale, No. 53, 1928.

The author successfully treated a woman who had a squamous celled epithelioma of introitus urethrae and cautions in connection with the report against the local application of radium. He strongly condemns the insertion of radium even into the urethral canal as too irritating in effect without at the same time affecting or influencing the development of the growth at the periphery, as this is apt to produce the great danger of necrosis of the bone. According to him the best method of treatment is the application of radium at a distance according to the method advocated by Reagaud. This form of treatment is far superior to surgical procedures, which, however, may have to be resorted to for the extirpation of the glands.

The Management of Malignancies in Otolaryngology. Joseph C. Beck, M. D. The Ohio State M. J., Mar., 1929, Vol. XXV, No. 3.

The original report appeared in the March, 1928 issue of the Annals of Otology, Rhinology and Laryngology. Eight reasons are given by the author for the better results now obtained in the management of malignancies. Various locations on the head and neck have been treated. Coagulation, deep therapy, radium and surgery are discussed. The author, in dealing with carcinoma of the larynx, shows a special preference for laryngectomy. The conclusions drawn as a result of the study are:

1. In surgical diathermy we have a destructive surgical agent which is decidedly lethal in its action upon malignancy.

2. Until the specific etiologic factor in the production of malignancy is established the cure of cancer is dependent upan radical surgery and irradiation.

3. A sufficient number of cases of cancer cured by surgery and irradiation as outlined above, are on record to encourage us in the continuance of the management of these cases in this manner.

4. The co-operation of the various specialties are indispensable in obtaining satisfactory results.

5. Prevention of latent hemorrhage following surgical diathermy is affected by prophylactic ligation of the external carotid and gradual compression ligation of the common carotid.

6. Pain before, during and after operation may be best controlled by nerve block with alcohol or even gasserian ganglion root resection.

7. Statistics are only of value when the reporter and his results are under the supervision of an association such as, for instance, the American Society for Control of Cancer, because statistics as now gathered are of distinct personal equation.

Radiation Therapy in Malignant Disease With Special Reference to the Saturation Method. George E. Pfahler, M. D. Ill. M. J., Vol. LV, No. 3, March, 1929.

Radiation therapy has been recognized as a definite method in the treatment of malignant disease, and is superior for the treatment of cancer of the skin, the mouth, and the uterus.

The saturation method is, in my opinion, the superior method. It depends upon a prolonged effect of the radiation upon the malignant disease, to the limit of toleration of the surrounding normal tissue.

The method combines and makes necessary the greatest amount of knowledge concerning malignant disease, and the principles of the distribution of the radiation.

If all the knowledge that is now available is utilized we should cure practically all cancers of the skin (if treated while they are confined to the skin); 70 to 100 per cent of cancers of the breast (if operated upon while still confined to the breast) and 46 per cent if operation is combined with radiation, even after there are lymph nodes in the axilla, 50 to 75 per cent of cancers of the mouth should be cured if treated early and thoroughly by gamma radiation; and 48 to 80 per cent of cancers of the uterus should be cured if treated thoroughly and skillfully by radiation, in the earliest stages.

Radiotherapy in Tumors of the Pituitary Body. J. A. M. A. 92:16; 1336, Apr. 20, 1929.

M. Beclere recounts favorable results from radiotherapy in several cases of tumors of the hypophysis. From his personal statistics and from the statistics of his collaborators, it appears that, particularly in ophthalmic types, radiotherapy effects an enlargement of the visual field, an increase of the visual acuity, the disappearance of ocular paralysis, the disappearance of signs of hypertension and mental disorders, and improvement in metabolism. In some cases, a disappearance of genital disorders was noted. In agreement with Cushing, the author emphasizes the importance of the diagnosis of tumors of the pituitary body proper and of tumors of the surrounding area, Rathke's pouch, for example. The former are quite radio-sentitive; the latter are much less so. Beclere states that disorders of vision are the first to appear and serve to announce the presence of a tumor.

Light Therapy in Mental Hospitals. H. Dove Cormas, M. B. Am. J. Phys. Therap. 6:20-24, Apr. 29.

Actinotherapy has been practiced at Parkside Mental Hospital for nearly four years, and, from my experience, is a very necessary adjunct to the treatment of mental cases. It is employed as a routine for convalescent cases, whose recovery is thereby hastened.

Care is necessary in the choice of cases for treatment, the type which benefits to the greatest degree having already been indicated. Mention should, however, be made of the excellent results obtained in dementia praecox of the simple type, and also in the hebephrenic type after the acute phase has passed.

It is my opinion that every mental hospital should be equipped with ultraviolet ray apparatus for the treatment of mental disorders, as well as for the many physical diseases which are ameliorated by its use. Opportunity should also be given for more extensive study of this subject, which would give scope for wider research into its physiological relation to the psychoses and the nervous system generally.

Intrathoracic Malignancy. A. A. Schultz. J. Iowa St. Med. Soc. 19:167-171, April, 1929.

The author considered malignant chest tumors together, because of their usual origin in or near the mediastinum, and attempted to bring out the main points of their differentiation.

Early diagnosis of malignant chest tumors is of the greatest importance, because cures may be obtained in those cases, which have not become invasive. All patients with symptoms indicating pressure within the mediastinum should be given a fluoroscopic examination of the chest followed by an x-ray picture.

Hemoptysis in patients past middle age should suggest malignancy first and tuberculosis second. An idea of the type of tumor present can be gained from the result of radiatoin. Radiation promises a cure in many and palliation in practically all of the malignant chest neoplasms.

Peptic Ulcer: Evaluation of Methods of Diagnosis and Treatment. A. M. McKeithen. Kentucky Med. J. 27:197-201, May, 1929.

Duodenal ulcer is common, whereas gastric ulcer is relatively rare. Differential diagnosis cannot always be made except by the x-ray. Peptic ulcer is characterized by chronocity and periodicity. The chief symptom is pain which occurs at a definite interval after eating, and after each and every meal, and usually at night. Pain is typically relieved by ingestion of food and alkalies. Vomiting and hemorrhage occur in a small proportion of the cases. The accuracy of diagnosis by the roentgen ray is very high. The treatment of gastric ulcer should be surgical and every attempt should be made to excise it. Duodenal ulcer should be given ample opportunity to heal under medical management; surgery should be employed where there are complications, and in all cases that resist medical treatment. During the past decade great progress has been made in the diagnosis of peptic ulcer, and as conservative a line of treatment as will safely effect a cure is to be preferred in evaluating the various methods.

On the Generalized Effect of Radiations in Myelogenous Leukemia. M. M. Struma. Am. J. Med. Sc. 177;676-681, May, '29.

Radium and roentgen ray affect the hemopoietic centers by an indirect local effect. It is not yet clear whether this indirect effect is produced by the blood transfer of emanation to the bone marrow, or by the extra-medullary production of leukotomins, which are then transported to the bone marrow.

In the treatment of myelogenous leukemia by radium or roentgen ray it is the dosage rather than the place of application that is important.

What the General Practitioner Should Know About Radiation Therapy. W. F. Boggess. Kentucky Med. J., 27:227-233, May, 1929.

Radium is a powerful remedy, which in the hands of competent men is capable of being a tremendous help to the general practitioner which can restore many invalid and semi-invalid patients to perfect health and thereby promote the reputation of the physician.

Radium and x-ray is an effective remedy when used scientifically by capable operators—in many cases which formerly required dangerous and major operations with their attending mortality and morbidity.

Radium in the hands of capable men given in proper dosages and given with proper care is a safe remedy with few serious reactions and complications.

A Roentgenologic Consideration of Duodenitis. B. R. Kirklin. Radiol., 12:377-381, May, 1929.

In 1921 Judd directed attention to duodenitis, inflammation of the duodenal mucosa with or without actual ulceration. His observations have been corroborated from the histopathologic standpoint by MacCarty, Konjectzny, and Wellbrook. The present study of its roentgenologic manifestations is based on forty-five consecutive cases, without ulceration, observed in recent months at the Mayo clinic. This series indicates that duodenitis is characterized roentgenologically by marked irritability of the bulb which tends to empty itself quickly, but incompletely. As a rule, the bulb is small and grossly deformed by deep indentations, and its borders are less sharply defined than in cases of true ulcer. It differs also from typical ulcer in that a marginal niche or central fleck cannot be seen and does not cause gastric retention. Its positive distinction from frank ulcer is not yet feasible and it might be confounded with reflex spasm of the bulb, but it seems to warrant further study.